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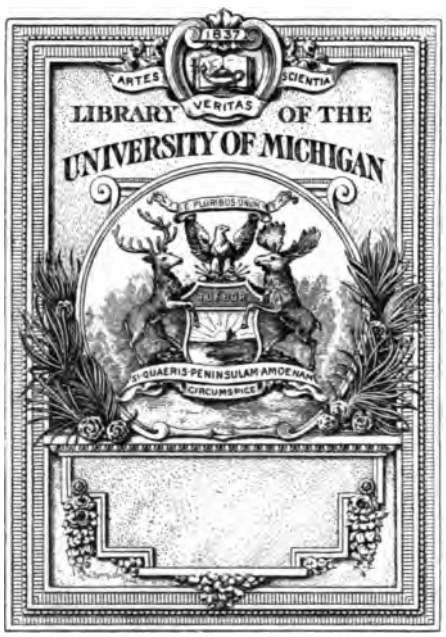

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WAR DEPARTMENT

Annual Reports, 1908

(IN NINE VOLUMES)

Volume V

Report of the

CHIEF OF ENGINEERS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1908

ARRANGEMENT OF THE ANNUAL REPORTS OF THE WAR DEP.
FOR THE YEAR ENDED JUNE 30, 1908.

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Inspector-General.
Judge-Advocate-General.

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Commissary-General.
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Chief Signal Officer.
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Volume V.....Chief of Engineers

Volume VI.....Chief of Ordnance.

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[a] Printed in Report of Chief of Engineers, Vol. V.
[b] Printed in Report of Chief of Ordnance, Vol. VI.

207261

REPORT

OF

THE CHIEF OF ENGINEE

UNITED STATES ARMY.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEE
Washington, September 29

SIR: I have the honor to present for your information lowing report upon the duties and operations of the Engineer ment for the fiscal year ending June 30, 1908.

OFFICERS OF THE CORPS OF ENGINEE

The number of officers holding commissions in the Corp gineers, United States Army, at the end of the fiscal year a net increase during the year of one.

Since July 1, 1907, the Corps of Engineers has lost 8 of its Col. Amos Stickney, who was retired from active service A 1907, by operation of law under the provisions of the act of approved June 30, 1882; Col. Garrett J. Lydecker, who wa from active service November 15, 1907, by operation of law u provisions of the act of Congress approved June 30, 18 John S. Sewell, who resigned his commission as an officer of January 31, 1908; Col. Charles E. L. B. Davis, who, on Feb 1908, vacated his commission as an officer of the Corps of E by his acceptance of his commission as brigadier-general, from January 29, 1908; Col. Joseph H. Willard, who wa from active service February 28, 1908, by operation of law u provisions of the act of Congress approved June 30, 18 Henry M. Adams, who was retired from active service May by operation of law under the provisions of the act of approved June 30, 1882; Brig. Gen. Alexander Mackenzie, Engineers, who was retired from active service May 25, operation of law under the provisions of the act of Congress June 30, 1882; Col. Clinton B. Sears, who was retired fro service June 2, 1908, by operation of law under the prov the act of Congress approved June 30, 1882.

There were added to the Corps of Engineers during the fi by the assignment of graduates from the Military Academy, lieutenants, whose commissions date from February 14, 1908

On the 30th of June, 1908, the distribution of officers of
according to their duties was as follows:

Acting Chief of Engineers, in command of the Engineer Department,	
Assistants to the Chief of Engineers	
River and harbor work	
River and harbor and fortification work	
River and harbor and fortification work in the Hawaiian Islands	
Public buildings and grounds in District of Columbia	
River and harbor work and light-house duty	
River and harbor and fortification work and light-house duty	
River and harbor work and chief engineer officers of military departn	
River and harbor and road work in Alaska	
On duty in the Philippine Islands	
On duty in Cuba	
With the Third Battalion of Engineers at Fort Leavenworth	
With engineer troops on the Pacific coast	
Engineer School and with troops stationed there	
Military Academy	
School of the Line	
General Staff	
Chief engineer officer, military department	
Engineer secretary of the Light-House Board	
Superintendent of State, War, and Navy building	
With the government of the District of Columbia	
On or under the Panama Canal Commission	
Indefinite leave of absence, in accordance with the joint resolution gress approved April 20, 1904	
Total	

A study of the above table indicates that 103 officers, or 6
of the total, are entirely detached from the supervision of th
Engineers; 44, or about 25 per cent of the total, are on du
within the jurisdiction of the Chief of Engineers; and 2
15 per cent of the total, have some duties under the supervi
Chief of Engineers, and others under various other bran
Government.

Eighty-six officers, which is exactly half of the Corps,
on military duty exclusively; 33 officers, or about 19 per
total, are engaged partly on military and partly on nonmi
and 52 officers, or 30 per cent of the total, are engaged o
duties exclusively.

The duties devolving upon the officers of the Corps
have been increasing year by year, and are now gre
before in its history. These duties at present include t
of fortifications, superintendence and execution of wor
harbor improvements, and the construction and repair
both in the United States and in the island possess
supply, municipal engineering, care of public buildi
and a share in the government of the capital city of t
the improvement of the Yellowstone National Park;
Northern and Northwestern lakes; the mining and
in the State of California; the chairmanship and
ship of the Panama Canal Commission and worl
mission, all of which involve the expenditure of
nually; and, in addition, various other duties, such
three battalions of engineer troops, the supervisi
gineering and reconnaissance work in the severa
and departments, instruction at the School of the

Academy, at schools of application, and membership in the General Staff.

The increasing demand for engineer officers for those of the duties mentioned which do not come under the supervision of the Chief of Engineers has caused a constantly increasing number to be detached from under his orders, until at present only 44 officers, or about one-fourth of the Corps, are left under full control of the department to attend to the important construction works, fortification, river and harbor, and other, devolving by law upon the Corps of Engineers. Deducting from this number the Chief of Engineers himself, the assistants in his office, and a small allowance for officers sick, on leave, or changing stations, there remains only about one officer for every two engineering districts, whereas there should be in each district at least one officer and in many districts two or more.

To be sure, as is shown by the table above, there are 25 officers partially under the jurisdiction of the Chief of Engineers while still engaged on work under other authorities, but in every one of these cases the duties coming to the officer from the Chief of Engineers are sufficient to fully occupy an efficient officer, and the additional work should properly fall to other officers, and would do so were there other officers available.

As was stated, the number of officers available for construction work under the Chief of Engineers has been decreasing, but quite the reverse is true of the work, which is now greater than ever before. River and harbor work is now going on under appropriations of a size previously unknown, and there is every reason to believe that the same will continue in the future. Fortification construction has recently been extended to the island possessions, and the character of the work at present, especially that connected with fire control and the electric installation, is such as to demand a much greater proportion of the immediate personal attention of the officers in charge. A large share of the Panama Canal work has been intrusted to the officers of the Corps, and in many other ways has an increase been evident.

Owing to the total inadequacy of the number of available officers it has been frequently necessary to combine works and districts and to thus throw upon many officers such a number and variety of duties as to make it difficult, if not impossible, for them to devote to the various items of work the proper amount of detailed consideration. Furthermore, it has become necessary to almost stop the extremely desirable custom, formerly in vogue, of assigning as assistants in construction districts young officers, in order that they may, by actual observation and practice, become fitted to assume charge of construction work, and in several cases recently it has been necessary to assign to the charge of important construction work an officer who has had no previous experience as an assistant on such work.

Under the circumstances, it is evident that if the work of the Corps of Engineers is to be carried on with the same high standard of efficiency that has previously characterized it, there must be an increase in the number of officers in the Corps in order that a greater number may be available for construction work. This matter has been given careful consideration, and a careful canvass has been made of the work to be done and of the number of officers in the Corps available for this work, and as a result of this study I have decided that

with the same enlisted strength as at present an increase of 60 in the authorized number of engineer officers is absolutely necessary to provide a sufficient number of officers for the work now devolving on the Corps. Furthermore, the increase on this account should be only in the grades above that of second lieutenant, as officers of that grade are not available for and should not be assigned either to the charge of construction work or as assistants thereon.

By an increase of 60 officers, affecting only the grades above that of second lieutenant, and distributed among those grades in proportion to the number of officers at present in each grade, there would be added to the authorized strength of the Corps of Engineers 4 colonels, 7 lieutenant-colonels, 13 majors, 18 captains, and 18 first lieutenants, which is the additional strength estimated on account of the large increase in civil work of the Corps.

NEW ENGINEER BATTALIONS.

The increase proposed in the preceding paragraph is due entirely to the need of officers for the important military and civil construction and supervisory work of the Corps of Engineers, and is in no way related to the demands for engineer troops and for officers to command them. At present three battalions of engineer troops are authorized by law and are officered from the Corps.

The work of the army properly falling to engineer troops has increased greatly in the recent past. Requests for the assignment of engineer companies or detachments have been received from many sources, and it has been impossible to comply with all of them. Owing to the demand for additional engineer troops, the War Department, under date of September 25, 1907, authorized the recruiting of the existing battalions up to their full war strength, but even this has been proven not to be sufficient, and important military surveys and other work properly belonging to engineer troops have been delayed, owing to the nonavailability of a sufficient number of engineer troops to do this work.

As showing the great demand for enginer troops, it should be noted that during the early part of the year 1907 nine out of a total of 12 engineer companies were needed for and were actually on duty in the Tropics, a much greater proportion than in the case of any other branch of the service, and a result arrived at only by leaving an entirely inadequate number of engineer troops for the work in the United States. This matter of an increase in the enlisted force of the Engineer Corps has been under consideration by the General Staff, and it is understood that there will be recommended an increase in the number of battalions from 3 to 6. In this recommendation I most heartily concur.

Not only do I concur in the increase of the number of engineer troops, but I would call attention to the fact that this increase in the enlisted force of the Engineer Corps necessitates a further increase in the number of engineer officers for the command of those troops, 19 additional officers being required for each battalion, or 57 in all, consisting of 3 majors, 12 captains, 30 first lieutenants, and 12 second lieutenants.

In addition, I consider it highly important for the proper supervision of the instruction and discipline of the engineer battalions

that they should be organized, at least provisionally, into regiments. Moreover, owing to the peculiar character of the work of these battalions and of the large size of the companies, it is believed that the engineer regiments should be composed of 2 battalions each, as in the Field Artillery, and not of 3 each, as in the infantry. To permit of this regimental organization, a colonel, a lieutenant-colonel, and 3 captains for duty on the regimental staff must be available for each regiment—that is, for the 6 battalions organized into 3 regiments of 2 battalions each, 3 additional colonels, 3 additional lieutenant-colonels, and 9 additional captains must be provided in the Corps of Engineers. In time of war each regiment should be increased by an additional battalion, possibly of volunteers.

The following tabular exhibit shows the increase proposed under the several headings discussed and the present and proposed authorized strength of the Corps. The increase is from a total authorized commissioned strength of 189 officers to a strength of 321 officers of all grades. The table shows also the proportion of each grade to the total number and that the recommendation for increase has been made with due regard for the equities of promotion as among the various branches of the service.

Schedule of proposed increase in the commissioned personnel of the Corps of Engineers, U. S. Army.

Increase on account of—	Grades.								
	Brig. Gen.	Col.	Lieut. Col.	Maj.	Chaplain.	Capt.	First Lieut.	Second Lieut.	Total.
Additional officers for military and civil works of construction	.....	4	7	13	.....	18	18	.....	60
Officers for additional three battalions	.....	.....	.....	3	.....	12	30	12	57
Officers for regimental organization	.....	3	3	.....	.....	9	.....	.....	15
Total increase	.....	7	10	16	.....	39	48	12	132
Present authorized strength	1	10	16	32	1	43	43	43	189
Total strength with proposed increase	1	17	26	48	1	82	91	55	321
Proportion of each grade to total number:		*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
Now	.....	5.3	8.0	16.9	0.5	22.8	22.8	22.8	.....
With proposed increase	.....	5.3	8.0	15.0	0.3	25.5	28.3	17.1	.....

A division of the total number of officers into the grades in the manner shown would reduce to about 29 per cent the proportion of officers above the rank of captain. The present proportion is about 32 per cent.

This increase, though apparently large, I believe to be essential to equip the Engineer Corps with officers sufficient to enable it to perform properly the numerous and important duties devolving upon it. It is, however, evident that this increase can not, without causing confusion, be made at once, and if made by permanent transfers without trial, it is probable that it can not be made at all without getting in some undesirable material. I would, therefore, recommend that the increase be made to extend over a period of about five years, and in the higher grades by promotion of officers now in the Corps and in the other grades by assignment of graduates of the Military Academy and by detail, for a term of years, of officers who

have graduated from the academy and are selected from the Army at large, officers thus detailed who may prove to be satisfactory to be permanently commissioned in the Corps of Engineers under such regulations as to grades and dates of commission as will equitably preserve their rights and those of officers previously in the Corps.

NONCOMMISSIONED OFFICERS OF ENGINEERS.

The relative standing of engineer noncommissioned officers has, in the recent past, been seriously lowered by the establishment in other branches of the service of special highly paid grades of noncommissioned officers without the creation of equivalent grades in the engineers. Thus, there have been established in the Signal Corps and Coast Artillery grades of sergeant first class, electrician sergeant first class, master electrician, and master signal electrician.

The work of engineer troops is of a high technical character, and requires, as far as the senior noncommissioned officers are concerned, a high grade of men, carefully and technically trained. Not only this, but the higher grades of engineer noncommissioned officers must not only be able to do this high grade of technical work themselves, but must be capable also of overseeing and managing large working parties of both troops and civilian laborers, and must, therefore, possess good executive ability. Just as good men are required for this work and as careful training is necessary as for any other branches of the service, and to prevent an unjust discrimination, similar or corresponding grades should at once be established in the Engineer Corps.

Engineer troops are frequently required to make military surveys of a high order, and it is highly important that there be among the enlisted men a number of well-trained surveymen, topographers, etc. The absence of such men has made it necessary in the past, whenever engineer troops were ordered to make instrumental surveys, to detail with these troops an increased number of engineer officers who were urgently needed elsewhere.

Many men about to enlist, and among them the most desirable class of recruits, look forward, in selecting a particular branch of the service, to the highest grade which they can reasonably expect to reach, and unless there be in the Engineer Corps grades as high as in the other technical branches of the service, it will be impossible to obtain for the engineers a proper proportion of the best class of recruits, similar to the men who have hitherto enlisted in the engineers. If this be not done a deterioration in the efficiency of the engineer battalions must inevitably result.

That the idea just expressed is not based on theory only is shown by the steady drain that has been going on in the last few months, of men transferring from the engineers and of discharged engineer soldiers who are reenlisting in other branches of the service.

If, therefore, the efficiency of the engineer troops is to be kept up to the proper standard, I recommend as urgently necessary:

First. That there be established in the engineers the grade of "Sergeant," first class, and that the authorized strength of each engineer company be increased by six such sergeants, first class, whose pay and emoluments shall be the same as that of the same grade in

the Signal Corps; and that the company quartermaster-sergeants of engineers shall rank as sergeants, first class.

Second. That there be established in the Corps of Engineers a new grade of "Military overseer," these soldiers to have the pay and emoluments authorized for master electricians and master signal electricians, the authorized number of such military overseers to be 100, to be assigned to duties and stations upon the recommendation of the Chief of Engineers.

Third. That the noncommissioned staff of each battalion be increased by a battalion train sergeant and a battalion commissary-sergeant, these noncommissioned officers to have the rank, pay, and emoluments of battalion sergeants-major.

THE BOARD OF ENGINEERS.

The regulations for the government of the Corps of Engineers provide for a Board of Engineers, consisting of not less than three officers designated by the Chief of Engineers, with the sanction of the Secretary of War. This Board acts in an advisory capacity to the Chief of Engineers upon important questions of engineering. One of its principal duties is to plan or revise the projects for permanent fortifications of the United States.

During the fiscal year the Board has reported upon various subjects connected with fortification work.

A statement of the composition of this Board during the last fiscal year will be found in its report.

(See Appendix No. 1.)

FORTIFICATIONS.

The scheme of national defense upon which work was in progress between 1888 and 1906 was based primarily upon a report submitted January 16, 1886, by the Endicott Board. On January 31, 1905, the President organized a board, with the Secretary of War as president, to review the projects for the United States and for the insular possessions, to indicate the localities where defenses are most urgently needed, and to determine the character and general extent of the defenses, with their estimated cost. This Board is known as the National Coast Defense Board. The Board submitted its final report February 1, 1906.

Permanent seacoast defenses have been installed at the following localities in the United States:

1. Kennebec River, Maine.
2. Portland, Me.
3. Portsmouth, N. H.
4. Boston, Mass.
5. New Bedford, Mass.
6. Narragansett Bay, Rhode Island.
7. Eastern entrance to Long Island Sound.
8. New York, N. Y.
9. Delaware River.
10. Baltimore, Md.
11. Washington, D. C.
12. Hampton Roads, Virginia.
13. Cape Fear River, North Carolina.
14. Charleston, S. C.
15. Port Royal, S. C.
16. Savannah, Ga.
17. Key West, Fla.
18. Tampa Bay, Florida.
19. Pensacola, Fla.
20. Mobile, Ala.
21. New Orleans, La.
22. Galveston, Tex.
23. San Diego, Cal.
24. San Francisco, Cal.
25. Columbia River, Oregon and Washington.
26. Puget Sound, Washington.

In accordance with the report of the Board above mentioned, additional defenses are to be constructed at some of these points, and also at the entrance to Chesapeake Bay, as soon as funds are provided by Congress.

Appropriations for construction of gun and mortar batteries have been made as follows:

Act of—		Act of—	
August 18, 1890	$1,221,000.00	May 7, 1898	$3,000,000.00
February 24, 1891	750,000.00	July 7, 1898	2,562,000.00
July 23, 1892	500,000.00	March 3, 1899	1,000,000.00
February 18, 1893	50,000.00	May 25, 1900	2,000,000.00
August 1, 1894	500,000.00	March 1, 1901	1,615,000.00
March 2, 1895	500,000.00	June 6, 1902	2,000,000.00
June 6, 1896	2,400,000.00	March 3, 1903	2,236,425.00
March 3, 1897	3,841,333.00	April 21, 1904	700,000.00
Allotments from the appropriation for "National defense," act of March 9, 1898	3,817,676.02	May 27, 1908	300,000.00
		Total	28,993,434.02

The following table shows the present status of permanent work completed or in progress with funds already provided:

Calibers.	Total number carried by scheme of National Coast Defense Board.	Provided for by appropriations made by Congress.
12-inch mortars	464	376
16-inch rifle	1	.....
14-inch rifles	19	.....
12-inch rifles	138	107
10-inch rifles	139	133
8-inch rifles	72	70
6-inch rapid-fire guns	191	175
5-inch rapid-fire guns	53	53
4.7-inch and 4-inch rapid-fire guns	38	38
3-inch rapid-fire guns	284	254

The defensive requirements of our seacoast may be subject to change to meet new requirements due to changes in commercial and naval vessels, but for present conditions the National Coast Defense Board scheme is sufficient. It carried an estimate amounting to $10,836,400 for emplacement construction (not including electrical light or power or land for sites). Appropriations to date aggregate $300,000, leaving $10,536,400 to be appropriated for these purposes. With the $300,000 provided by Congress at its last session for the construction of gun and mortar batteries in the United States, preparations are being made and detailed plans prepared for the active prosecution of work.

An estimate of $5,064 is submitted to cover the cost of the necessary modifications in one emplacement of a three-gun battery to permit the replacement of an experimental carriage of inferior type by an existing carriage of the same type as the other two now mounted in the battery.

At the close of the fiscal year the status of emplacements for which funds have been provided by Congress is as follows:

	12-inch mortars.	12-inch.	10-inch.	8-inch.	Rapid-fire.
Guns mounted	376	[a] 105	[b] 126	[c] 94	[d] 406
Ready for armament	.....	.....	7	5	[e] 111
Under construction	.....	2	.....	.....	4
Total	376	107	133	99	521

[a] Including 2 guns on hydraulic lifts.
[b] Including original experimental 10-inch carriage, now dismounted.
[c] Including 26 which have been dismounted since the war with Spain, 3 which are now temporarily mounted, and 3 which have been dismounted for emplacement elsewhere.
[d] One temporarily.
[e] Excluding 70 6-pounders not requiring permanent emplacements which have been included in former reports.

At the close of the previous fiscal year there were reported mounted:

12-inch mortars.	12-inch.	10-inch.	8-inch.	Rapid-fire.
376	105	122	94	[a] 355

[a] Erroneously stated in the report of last year as 455.

A comparison of the last two tables shows an increase during the year in guns actually available for service of 4 10-inch guns and 51 rapid-fire guns.

The following table shows that the Engineer and Ordnance departments have worked in harmony, the numbers of gun carriages and emplacements being the same, except where extra carriages are needed for purposes other than seacoast defense:

Type of gun or carriage.	Total carriages provided.	Total emplacements provided.
12-inch mortar carriages, model 1896	[a] 298	296
12-inch mortar carriages, model 1891	[b] 85	80
12-inch disappearing carriages, L. F., model 1901	13	13
12-inch disappearing carriages, L. F., model 1897	35	35
12-inch disappearing carriages, L. F., model 1896	27	27
12-inch gun-lift carriages, altered to nondisappearing	3	3
12-inch gun-lift carriages, model 1891	[c] 2	[d] 2
12-inch nondisappearing carriages, model 1892	28	28
10-inch disappearing carriages, A. R. F., model 1896	3	3
10-inch disappearing carriages, L. F., model 1901	12	12
10-inch disappearing carriages, L. F., model 1896	74	74
10-inch disappearing carriages, L. F., model 1894	[e] 35	35
10-inch nondisappearing carriages, model 1893	[f] 10	9
8-inch disappearing carriages, L. F., model 1896	38	40
8-inch disappearing carriages, L. F., model 1894	[g] 26	26
8-inch nondisappearing carriages, model 1892	[h] 9	[i] 9

[a] Two at Sandy Hook proving ground.
[b] One in use at West Point; 4 in storage.
[c] One has been altered for use at proving ground.
[d] Armament dismounted.
[e] One carriage is the original experimental one for this caliber of gun, and has been put out of service at the instance of the Coast Artillery Corps.
[f] One at Sandy Hook proving ground. The number of carriages of this type provided for exceeds by 1 the number which the Chief of Engineers has notified the Chief of Ordnance are required for the emplacements he has provided.
[g] One carriage is the original experimental one for this caliber of gun.
[h] One at West Point and 1 at Sandy Hook proving ground.
[i] Five temporary; armament removed from 3.

Type of gun or carriage.	Total carriages provided.	Total emplacements provided.
15-inch smoothbore carriages altered for 8-inch rifles	21	[a] 21
6-inch disappearing carriages, model 1905	4	4
6-inch disappearing carriages, model 1903	90	90
6-inch disappearing carriages, model 1898	29	29
6-inch rapid-fire (Vickers Son & Maxim), pedestal mounts	8	8
6-inch rapid-fire, pedestal mounts, model 1900	[b] 45	44
5-inch balanced-pillar mounts, model 1896	82	82
5-inch pedestal mounts, model 1903	21	22
4.7-inch rapid-fire (Armstrong pattern), pedestal mounts	[c] 34	33
4.7-inch rapid-fire (Schneider pattern), pedestal mounts	1	[d] 1
4-inch rapid-fire (Driggs-Schroeder), pedestal mounts	4	4
3-inch balanced-pillar mounts	114	114
3-inch casemate mounts	2	2
3-inch pedestal mounts, model 1902	60	60
3-inch pedestal mounts, model 1903	[e] 79	78
2.24-inch rapid-fire field carriages and rampart mounts	70	(f)

[a] Temporary; armament removed from 20.
[b] One at Sandy Hook proving ground.
[c] One to be sent to Sandy Hook proving ground.
[d] Temporary.
[e] One at Sandy Hook proving ground.
[f] Movable mounts.

Modernizing older emplacements.—By the act approved May 27, 1908, authority was granted to apply the sum of $165,261.36, formerly appropriated for the construction of pneumatic dynamite batteries (but unspent, due to the abandonment of that form of ordnance), to the initiation of mechanical powder service. The experimental development of apparatus for this purpose has been practically completed, and arrangements for the manufacture and installation of the machines are now in progress.

A considerable amount of work remains to be done to place the batteries in a thoroughly satisfactory condition for efficient operation, including powder hoists in gun emplacements, widening loading platforms, electric wiring of emplacements, to place fire-control-communication instruments on the gun carriages, and platform lighting. Detailed estimates have been prepared for the work of the above classes required at all emplacements in the United States; the aggregate of the estimates is $1,066,100. For carrying on work of this character during the coming year an estimate of $500,000 is submitted.

Fire control at fortifications.—The fortification act approved March 2, 1907, provided the sum of $900,000 for this purpose, to be distributed in the discretion of the Secretary of War among the Engineer and Ordnance departments and the Signal Corps. Of this amount the sum of $432,784.81 was assigned to the Engineer Department. Engineer work is now in progress with these funds and will be well advanced toward completion by the close of the present working season.

The fortification act of May 27, 1908, provided the sum of $270,256 for this purpose. Detailed plans and estimates for the prosecution of the engineer work required under this appropriation were being prepared at the close of the fiscal year, and it is expected that a substantial beginning in the actual installation will be made during the present working season.

An estimate of $1,785,009 to cover the work of the Engineer and Ordnance departments and the Signal Corps under this head for the next fiscal year has been prepared by the Chief of Coast Artillery.

Electrical installations.—The National Coast Defense Board estimated that $5,216,031 would be required to furnish the necessary electrical equipment for the defenses of the United States in addition to the current required for searchlights.

The fortification act of May 27, 1908, provided the sum of $348,888 for this purpose, and arrangements for the installation of electric plants at posts where the requirements are most urgent have been commenced.

For continuing the installation of this equipment at the defenses where the Chief of Coast Artillery states they are most needed an estimate of $984,253 is submitted.

Sites for fortifications.—During the previous fiscal year a site was acquired at Boston, Mass., a part of the purchase money being withheld, in accordance with the terms of the sale, until a wall separating the tract acquired from adjacent ground has been built by the city of Boston. During the past year the construction of the wall has been in progress, but it is not yet completed.

The sum of $121,048 was provided by Congress at its last session for this purpose; the appropriation act contained a proviso that not more than $21,048 of the amount appropriated should be paid for property at, near, or adjoining Fort Armistead, Md. A tract of land adjoining Fort Armistead has been purchased, all provisions of the law having been complied with. Negotiations are now in progress looking toward the acquisition of additional land where it is most urgently needed, and it is expected that the entire amount appropriated will soon be definitely pledged.

For the purchase of additional land where most needed an estimate of $250,000 is submitted.

Searchlights.—With funds provided in the fortification act approved March 2, 1907, a number of generating sets have been contracted for and deliveries have commenced. Eight projectors of a new type developed abroad and two of a new type of domestic manufacture have been purchased and issued to the troops for the test of actual use, and two others, also of domestic make, have been obtained from the Navy Department for remodeling. All these projectors are being subjected to trials under actual service conditions, in comparison with the lights heretofore purchased, with an idea to developing the very best form of searchlight for the use of the troops. It is anticipated that contracts covering the balance available from the 1907 appropriation act and the $210,000 provided in the act approved May 27, 1908, will be let during the present fiscal year.

For the purchase of additional searchlights regarded by the Chief of Coast Artillery as emergently necessary, an estimate of $907,000 is submitted.

Preservation and repair of fortifications.—The modern works of defense now constructed represent an expenditure of approximately $28,000,000 for engineering work alone. For the preservation and repair of these works during the present fiscal year there was appropriated the sum of $225,000, less than 1 per cent of the cost of construction. These extensive works contain much costly machinery and

ordnance material and must be kept properly painted and repaired to be effective when needed. The $225,000 appropriation of the act of May 27, 1908, is not sufficient to keep the essential features of the fortifications in satisfactory condition for an entire year.

An estimate of $300,000 for preservation and repair is submitted, and it is strongly recommended (in the interest of economy and efficient service) that this amount be appropriated.

Repair and protection of defenses of Charleston, Pensacola, Mobile, and New Orleans.—For repairs and sea walls at these localities, rendered necessary by storms, the following estimates were submitted to Congress in 1906:

Charleston, S. C., for the construction of the sea wall necessary for the protection of Fort Moultrie	$225,600
Pensacola, Fla., for building sea walls for the protection of the sites of the fortifications and of the necessary post buildings at Forts Pickens and McRee	907,100
Pensacola, Fla., for repair and restoration of batteries and other structures appurtenant to the defenses of Pensacola, and for retaining walls to protect the batteries from floods	109,355
Mobile, Ala., for repair and restoration of batteries and other structures appurtenant to the defenses of Mobile, and for rebuilding sea walls and groins for protection of the sites of the fortifications of the garrison posts	1,089,500
New Orleans, La., for rebuilding and strengthening the levees for protection of the site of the defenses and the garrison post at Fort St. Philip	139,800

At the last two sessions appropriations have been made by Congress covering the estimates for Charleston and Mobile, and providing $400,000 for the sea walls at Pensacola and $100,000 for the levees at Fort St. Philip. In the former case a limit of cost identical with the total estimate submitted was authorized by Congress in the fortification appropriation act approved June 25, 1906, but no appropriation for the completion of the work was made at the last session of Congress, it being thought that, owing to delays in the commencement of the work, additional funds would not be necessary until next year. The work is now under contract and is progressing satisfactorily, and the remainder of the estimated cost should now be provided. An estimate of $507,100 for this purpose is accordingly submitted.

At Fort St. Philip, New Orleans, the sum of $100,000 was appropriated, but authority to initiate the proposed protective levees in their entirety was not given. A portion of the reservation is therefore protected and the balance abandoned to overflow until further funds are available. Floods are higher than formerly, due to the building of levees below the forts. It is estimated that $40,000 will be required to render the Fort St. Philip reservation reasonably safe against floods in future, and an estimate of that amount is submitted.

Supplies for seacoast defenses.—Owing to the large number of electric installations supplying power and light in seacoast batteries, funds have been appropriated annually for "tools and electrical and engine supplies for use of the troops for maintaining and operating light and power plants in gun and mortar batteries." This appropriation is designed to enable the Engineer Department to comply with the regulations of the War Department for the supply and service of the batteries. Requisitions are made upon the Chief of Engineers, through the district engineer officers, and authorized articles are purchased and issued by district engineer officers with as little

delay as possible. This system has proved eminently satisfactory to the garrisons.

The amount appropriated for this purpose in the act approved May 27, 1908, was $44,500, the sum of $4,500 having been added to the regular annual estimate in order to permit the supply of wattmeters at certain electric plants. These wattmeters are now being procured.

As the earlier electric plants become worn with use, and as additional plants are installed from time to time, the demands upon the funds for the purchase of these supplies increase. While great economy was exercised during the past year in the use of the $40,000 appropriated by the act of March 2, 1907, considerable difficulty was experienced in providing sufficient funds to all districts for the purchase of absolutely necessary supplies.

The sum of $45,000 is estimated as necessary for the procurement of the regular electrical supplies for the next fiscal year, as supplies will have to be furnished to five new large central plants on the Pacific coast where prices are high. In addition, the issue of reserve electric lights of a form approved after exhaustive tests by the Artillery has been requested by the Chief of Coast Artillery, and is believed to be desirable by the Chief of Engineers. They will cost $19,500 additional to the $45,000. An estimate of $64,500 is accordingly submitted to cover these items for the period to be covered by the next appropriation.

Sea walls and embankments.—The sum of $50,000 was appropriated for this purpose by the fortification appropriation act approved May 27, 1908. This amount is being applied to such work only as becomes urgently necessary for the protection of the defensive works.

Based upon detailed estimates prepared by district engineer officers, an estimate of $145,914 is submitted for the construction of sea walls and embankments at a number of localities on the Atlantic and Gulf coasts, where they are needed to protect the defenses.

Sea walls, defenses of Galveston, Tex.—The defensive works at Galveston were unavoidably in most exposed positions, and the level of the lands surrounding the batteries was greatly lowered by the storm of September 8, 1900. Work of reconstruction and repair of the Galveston defenses is now completed under the appropriation contained in the fortification act approved March 1, 1901. With the funds so provided, and in accordance with the plans before Congress when that appropriation was made, each individual battery has been made secure against any similar storms which are likely to occur in the future, but no provision has been made to protect the sites on which quarters, barracks, and other post buildings must be located, except at Fort Crockett. For building a sea wall and filling up the reservation at this fort to a height above storm tides the sums of $591,046.25 and $158,953.75 were appropriated in the sundry civil appropriation acts of April 28, 1904, and June 30, 1906, aggregating $750,000. Under the latter appropriation the work at Fort Crockett is now practically completed.

Similar protection is required at Forts San Jacinto and Travis, if these forts are to be garrisoned. There are certain claims to portions of the former reservation adverse to the title of the United States, one of which claims is now before the courts. Until all clouds upon the title of the United States are removed, no money should be expended on this reservation. At Fort Travis there are no such at-

verse claims. The urgency of protection and fill is dependent upon the date when troops are to be assign teries. No structures required for garrison purpose control stations can be safely built till after the sea v Experience in the construction of the sea wall at Fo plainly indicated modifications in the plans formerl the Fort Travis sea wall. The estimated cost of the n $440,000, and an estimate of that amount is submittec

Preservation and repair of torpedo structures.—A l new torpedo-defense structures have been completed, in addition, are approaching completion. An estimat submitted for the preservation and repair of these buildings. The appropriations made to date for bu structures aggregate $2,303,000, and it is believed that mate for maintenance is reasonable when considered with the original cost of the buildings.

The appropriation act of May 27, 1908, contained an for this purpose. This sum is being applied to such m are found from time to time to be most urgently neces

Submarine mines.—While the operation of torpedo duty of the Coast Artillery Corps, the building of stru in connection therewith is under the charge of the En ment.

To complete the engineer structures for the torped ommended by the National Coast Defense Board, entrance to Chesapeake Bay and at Galveston, Tex. (w the present status of the defenses and garrison posts, it ered advisable to build the torpedo structures immedi mate of $289,964 is submitted, in accordance with the Chief of Coast Artillery.

The sum of $175,000 provided in the fortification a 1908, is being applied in accordance with the artillery s

Batteries in insular possessions.—The first appropr purpose was contained in the fortification act appr 1904, and additional appropriations have been made four succeeding years, the aggregate amount approp being $3,714,000. With these appropriations batteries structed at Guantanamo Bay, Cuba, and construction progress at Honolulu and Pearl Harbor, Hawaii, an Subic Bay, Philippine Islands.

The defense of the important harbors of the insular been specially considered by the National Coast Defen any funds appropriated for batteries will be applied with the general projects of that Board. For the const teries to be begun next year an estimate of $2,818,40 $449,400 to complete the defenses of Honolulu and Hawaii, and $2,369,000 to provide some very necess defenses at Manila, on existing islands. If the total can not be made, at least $2,000,000 should be made av a substantial plant can be provided and work be co effective and economical manner.

Electrical installations, insular possessions.—The N Defense Board estimated that $788,713 would be requi the necessary electrical equipment for the defenses of t

sessions, in addition to the current required for searchlights. beginning the installation of this equipment, the sum of $135,00 provided in the fortification appropriation act of May 27, $20,000 for the Hawaiian Islands and $115,000 for the Phili Islands. Work under these appropriations is now in progress. the continuation of this work an estimate of $230,638 is subm $14,469 for the Hawaiian Islands and $216,169 for the Phili Islands.

Fire control at batteries in insular possessions.—The fortifi act of May 27, 1908, provided $243,000 for this purpose, whicl was available for the work of the Engineer and Ordnance d ments and the Signal Corps. Of this appropriation the su $75,000 is being applied to the work of the Engineer Departme

An estimate for this work will, it is understood, be submitted l Chief of Coast Artillery.

Searchlights, insular possessions.—For this purpose the su $227,500 was appropriated in the act of May 27, 1908, $47,500 f Hawaiian Islands and $180,000 for the Philippine Islands. funds are being applied to the purpose for which appropriated. the purchase of additional searchlights for use in connection wi defenses, an estimate of $194,400 is submitted, $112,800 fo Hawaiian Island and $81,600 for the Philippine Islands. estimates, added to the appropriations already made, somewh ceed the estimates of the National Coast Defense Board at localities, but the equipment to be purchased with them is requi complete searchlight projects now adopted by the artillery.

Submarine mines, insular possessions.—The sum $129,000, a priated in the last fortification act for the construction of to structures for the defense of the Hawaiian Islands, will be appl the purpose for which appropriated. Detailed plans are now prepared.

Procurement of sites, insular possessions.—For the procurem land, or rights pertaining thereto, in the Philippine Islands, th of $5,000 was provided by the last fortification act. The own all the tracts to be acquired have agreed to sell at prices which been approved as satisfactory to the United States by a boa officers constituted to appraise the land. These prices aggrega sum of ₱31,976 or $15,988. It is believed that condemnation pr ings should be resorted to before the title is finally acquired b United States. An estimate will be submitted when the cond value of the land is known.

The following money statements show the condition on Ju 1908, of all general appropriations under which operations w progress at the close of the fiscal year:

"GUN AND MORTAR BATTERIES."

For battery construction.

July 1, 1907, balance unallotted	$57,
May 27, 1908, appropriated	300,
	357,
June 30, 1908, net allotments during the fiscal year	44,
July 1, 1908, balance unallotted	313,
July 1, 1908, amount pledged	[illegible]

For modernizing older emplacements.

July 1, 1907, balance unallotted	$10,785.95
May 27, 1908, made available	165,261.36
	176,047.31
June 30, 1908, net allotments during the fiscal year	8,750.95
July 1, 1908, balance unallotted	167,296.36
July 1, 1908, amount pledged	167,296.36

"FIRE CONTROL AT FORTIFICATIONS."

July 1, 1907, balance unallotted	$88,832.82
June 30, 1908, net allotments during the fiscal year	46,133.78
July 1, 1908, balance unallotted	42,699.04
July 1, 1908, amount pledged	42,699.04

(Funds not yet assigned to the Chief of Engineers from the act of May 27, 1908.)

"ELECTRICAL INSTALLATIONS AT FORTIFICATIONS."

May 27, 1908, appropriated	$348,888.00
June 30, 1908, net allotments during the fiscal year	501.00
July 1, 1908, balance unallotted	348,387.00
July 1, 1908, amount pledged	348,387.00

"SITES FOR FORTIFICATIONS AND SEACOAST DEFENSES."

July 1, 1907, balance unallotted	$49,622.06
May 27, 1908, appropriated	121,048.00
	170,670.06
June 30, 1908, net allotments during the fiscal year	1,065.39
July 1, 1908, balance unallotted	169,604.67
July 1, 1908, amount pledged	169,604.67

"SEARCHLIGHTS FOR HARBOR DEFENSES."

July 1, 1907, balance unallotted	$315,136.44
May 27, 1908, appropriated	210,000.00
	525,136.44
June 30, 1908, net allotments during the fiscal year	278,235.44
July 1, 1908, balance unallotted	246,901.00
July 1, 1908, amount pledged	236,964.50
July 1, 1908, balance available	9,936.50

"PRESERVATION AND REPAIR OF FORTIFICATIONS."

May 27, 1908, appropriated	$225,000.00
June 30, 1908, net allotments during the fiscal year	8,361.00
July 1, 1908, balance unallotted	216,639.00
July 1, 1908, amount pledged	[a] 216,639.00

"PLANS FOR FORTIFICATIONS."

May 27, 1908, appropriated	$5,000.00
June 30, 1908, net allotments during the fiscal year	5,000.00

[a] All allotted prior to September 30, 1908.

"SUPPLIES FOR SEACOAST DEFENSES."

July 1, 1907, balance unallotted	$5,521.00
May 27, 1908, appropriated	44,500.00
	50,021.00
June 30, 1908, net allotments during the fiscal year	5,510.96
July 1, 1908, balance unallotted	44,510.04
July 1, 1908, amount pledged	44,510.04

"SEA WALLS AND EMBANKMENTS."

July 1, 1907, balance unallotted	$6,212.66
May 27, 1908, appropriated	50,000.00
	56,212.66
June 30, 1908, net allotments during the fiscal year	39,167.77
July 1, 1908, balance available for emergencies during the fiscal year	17,044.89

"PRESERVATION AND REPAIR OF TORPEDO STRUCTURES."

July 1, 1907, balance unallotted	$284.73
May 27, 1908, appropriated	15,000.00
	15,284.73
June 30, 1908, net allotments during the fiscal year	12,363.53
July 1, 1908, balance unallotted	2,921.20
July 1, 1908, amount pledged	400.00
July 1, 1908, balance available	2,521.20

"CASEMATES, GALLERIES, ETC., FOR SUBMARINE MINES."

July 1, 1907, balance unallotted	$100,199.17
May 27, 1908, appropriated	175,000.00
	275,199.17
June 30, 1908, net allotments during the fiscal year	201,075.03
July 1, 1908, balance unallotted	74,124.14
July 1, 1908, amount pledged	73,980.84
July 1, 1908, balance available	143.30

"FORTIFICATIONS IN INSULAR POSSESSIONS."

For construction of seacoast batteries.

July 1, 1907, balance unallotted	$504,706.26
May 27, 1908, appropriated	1,354,000.00
	1,858,706.26
June 30, 1908, net allotments during the fiscal year	468,314.86
July 1, 1908, balance unallotted	1,390,391.40
July 1, 1908, amount pledged	1,390,391.40

For electrical installations at seacoast fortifications.

May 27, 1908, appropriated	$135,000.00
June 30, 1908, net allotments during the fiscal year	7,426.00
July 1, 1908, balance unallotted	127,574.00
July 1, 1908, amount pledged	75,557.60
July 1, 1908, balance available	52,016.40

For searchlights.

July 1, 1907, balance unallotted	$17,963.00
May 27, 1908, appropriated	227,500.00
	245,463.00
June 30, 1908, net allotments during the fiscal year	18,173.00
July 1, 1908, balance unallotted	227,290.00
July 1, 1908, amount pledged	227,290.00

For casemates, galleries, etc., for submarine mines.

May 27, 1908, appropriated	$129,000.00
June 30, 1908, net allotments during the fiscal year	232.16
July 1, 1908, balance unallotted	128,767.84
July 1, 1908, amount pledged	128,767.84

For sites, Hawaiian Islands.

July 1, 1907, balance unallotted	$151,425.51
June 30, 1908, net allotments during the fiscal year	36,997.50
July 1, 1908, balance unallotted	114,428.01
July 1, 1908, amount pledged	114,428.01

For sites, Philippine Islands.

May 27, 1908, appropriated	$5,000.00
July 1, 1908, amount pledged	5,000.00

"FIRE CONTROL IN INSULAR POSSESSIONS."

July 1, 1907, balance unallotted	$75,000.00
June 30, 1908, net allotments during the fiscal year	75,000.00

(NOTE.—The sum of $75,000, from the act of May 27, 1908, was assigned to the Chief of Engineers by the Secretary of War on July 2, 1908. This amount was pledged prior to September 30, 1908.)

ESTIMATES OF APPROPRIATIONS REQUIRED FOR 1909–10 FOR FORTIFICATIONS.

Gun and mortar batteries:		
For construction of gun and mortar batteries	$5,064.00	
For modernizing older emplacements	500,000.00	
		$505,064.00
Electrical installations at seacoast fortifications		984,253.00
Sites for fortifications and seacoast defenses		250,000.00
Searchlights for harbor defenses		907,000.00
Preservation and repair of fortifications		300,000.00
Repair and protection of defenses of Pensacola, Fla.:		
For sea walls		507,100.00
Repair and protection of defenses of New Orleans, La		40,000.00
Plans for fortifications		5,000.00
Supplies for seacoast defenses		64,500.00
Sea walls and embankments		145,914.00
Sea walls, defenses of Galveston, Tex.:		
For Fort Travis		440,000.00
Preservation and repair of torpedo structures		50,000.00
Casemates, galleries, etc., for submarine mines		289,964.00
Fortifications in insular possessions:		
For seacoast batteries—		
Honolulu and Pearl Harbor	$449,400.00	
Manila, P. I	2,369,000.00	
For installation of electric plants—		
Honolulu and Pearl Harbor	14,469.00	
Philippine Islands	216,169.00	
For searchlights—		
Pearl Harbor and Honolulu	112,800.00	
Philippine Islands	81,600.00	
		3,243,438.00
Total		7,732,238.00

ENGINEER DEPOTS AT WASHINGTON BARRACKS, DISTRICT OF COLUMBIA, FORT LEAVENWORTH, KANSAS, AND FORT MASON, CALIFORNIA.

Officers in charge: Depot at Washington Barracks, Maj. E. Eveleth Winslow, Corps of Engineers, until August 1, 1907, and Lieut. Col. William C. Langfitt, Corps of Engineers, since that date; depot at Fort Leavenworth, Maj. Thomas H. Rees, Corps of Engineers, and depot at Fort Mason, Capt. Meriwether L. Walker, Corps of Engineers, until July 5, 1907; First Lieut. Jarvis J. Bain, Corps of Engineers, until September 16, 1907; First Lieut. Clarence H. Knight, Corps of Engineers, until April 30, 1908, and Capt. Francis A. Pope, Corps of Engineers, to the end of the fiscal year.

ENGINEER DEPOT, WASHINGTON BARRACKS.

This depot is the repository for part of the military bridge equipage of the Army; for miscellaneous military engineering tools, supplies, and materials of all kinds, and for astronomical, surveying, drafting, and reconnaissance instruments and supplies used by the Army and by officers of the Corps of Engineers on public works, both military and civil. It purchases and issues military engineering tools and supplies and serves particularly as an exchange for engineer instruments of all kinds, receiving them from the Army or public works, caring for them while in store, causing to be made the necessary repairs, reissuing them when required, and, so far as limited appropriations will permit, making purchases of such items as can not be supplied from store.

The general work of the depot consisted of care of the property on hand, purchase of new articles, and shipment to troops of supplies as needed. The work this year is believed to have exceeded that of any previous one, the total weight of supplies shipped and received being estimated at approximately 350,000 pounds.

The old building used for various shops pertaining to the depot and for other purposes connected with the Engineer School was demolished by the Quartermaster's Department, being on the part of the reservation assigned to the War College. As the shops are a most essential part of the depot, a new building should be provided for immediately. An estimate for this building is included in the estimates to be submitted to Congress at its next session. There is no available place on the post for the storage of the various wagons pertaining to the bridge trains, and the space available for the storage of miscellaneous lumber and bridge material is far too small. These imperative needs of the depot should be attended to at an early date. Roughly estimated, the construction of such a shed for the protection of ponton wagons and other heavy bulky ponton material, and for protecting all sorts of lumber used at the depot for various purposes, would cost about $12,500; an estimate for this structure will also be included in the estimates to be submitted to Congress at its next session.

ENGINEER DEPOT, FORT LEAVENWORTH.

This depot is maintained for the purpose of issuing supplies to the battalion of engineers there stationed, and for the storage, repair, and manufacture of ponton material.

The erection of two stables, two ponton sheds, one stable guardhouse, and one shop building, by the Quartermaster's Department, completes the project inaugurated in 1902 for the engineer depot and park, and provides protection for two divisions of each of the reserve and advance-guard equipage, the horses, draft and pack mules of the companies, and the mules to haul one division of the reserve train.

When the engines and machines are installed in the new shop building, the shop will be well equipped for any kind of woodwork connected with the construction of ponton equipage (particularly advance-guard and reserve boats), and for repairs in both wood and iron. The shop was in operation from November 1, 1907, to June 30, 1908, engaged in the fabrication and repair of engineer equipment. During the first half of this period most of the shopwork consisted in repairs to equipment, necessitated by the service of the battalion in Cuba from February 10, 1907, to June 7, 1907, and at Fort Riley, Kans., from September 1, 1907, to October 12, 1907. During the latter half of the period a large number of chess, balk, and trestles were constructed. With the exception of the wagons of the ponton equipage, all property carried on the depot property return is in excellent condition and ready for immediate and hard use. When the 15 new chess wagons and 20 new ponton wagons are received the depot will be able to turn out 4 divisions of ponton equipage (2 advance and 2 reserve) in excellent condition, and the greater part of a supply division as well. The greatest need now is suitable lumber to build reserve ponton boats.

ENGINEER DEPOT, FORT MASON.

The ponton equipment was put in serviceable condition. No material for balk or chess was purchased, as the material for the same was received from Maj. H. M. Chittenden, Corps of Engineers, and has been almost worked up and put in condition for use. Some of the old balk are now in a very poor condition, and will soon be put before an inspector with a view to having them condemned. All of the ponton train has received a very good overhauling and painted, and is now in very fair condition.

The depot was maintained, enlisted men being employed on extra duty as overseer, mechanics, and photographer.

The details of the operations of the depots, including purchase, issue, and care of all stores, will be found in the reports of the officers in charge.

ENGINEER DEPOTS, 1908.

Incidentals.

Amount appropriated in the army appropriation act of March 2, 1907	$11,500.00	
Amount received in payment for blue-print paper	4.38	
		$11,504.38
June 30, 1908, amount expended during fiscal year		9,643.81
July 1, 1908, balance unexpended		1,860.57
July 1, 1908, outstanding liabilities		1,860.57

Instruments.

Amount appropriated in the army appropriation act of March 2, 1907	$5,000.00
June 30, 1908, amount expended during fiscal year	4,906.93
July 1, 1908, balance unexpended	93.07
July 1, 1908, outstanding liabilities	93.07

ESTIMATES OF APPROPRIATIONS REQUIRED FOR THE ENGINEER DEPOTS FOR 1909–10.

For incidental expenses of the depots, including fuel, lights, chemicals, stationery, hardware, machinery, pay of civilian clerks, mechanics, and laborers, extra-duty pay to soldiers necessarily employed for periods not less than ten days as artificers on work in addition to and not strictly in the line of their military duties, such as carpenters, blacksmiths, draftsmen, printers, lithographers, photographers, engine drivers, telegraph operators, teamsters, wheelwrights, masons, machinists, painters, overseers, laborers, repairs of, and for materials to repair, public buildings and machinery, and unforeseen expenses	$20,000.00
For purchase and repair of instruments, to be issued to officers of the Corps of Engineers and to officers detailed and on duty as acting engineer officers for use on public works and surveys	10,000.00
Total	30,000.00

(See Appendixes 2, 3, and 4.)

ENGINEER EQUIPMENT OF TROOPS.

By the act of Congress approved March 2, 1907, the sum of $40,000 was appropriated for the procurement of ponton material, tools, instruments, and supplies required for use in the engineer equipment of troops in the field. This appropriation was limited to the fiscal year 1908.

With these funds engineering supplies were furnished, mainly through the United States engineer depots, for the various military divisions and departments in the United States and the Philippines and for the army of pacification in Cuba; the engineer troops were supplied, so far as possible, with the company equipment called for by General Orders, No. 9, Office, Chief of Engineers, 1906; and the purchase and issue of reconnaissance outfits to military posts and organizations required by General Orders, No. 24, War Department, 1905, as amended by General Orders, No. 73, War Department, 1907, and General Orders, No. 113, War Department, 1906, was continued.

The Engineer Field Manual, Professional Papers, No. 29, Corps of Engineers, mentioned in the last annual report, has been published, the six parts being put under one cover. The manual is distributed by the Second Section, General Staff.

The 37 chess wagons under contract at close of last fiscal year were delivered and distributed to Manila, San Francisco, and Fort Leavenworth.

Approximately $20,000 was allotted for the improvement of the authorized bridge equipage. Numerous repairs were made to the material on hand; 8 ponton wagons, 4 frames for canvas boats, 6 sets trestles, 6 saddle sills, and 9 abutment sills were constructed at the depot at Washington Barracks, where also was purchased the material for and completed 32 long and 78 short chess and 15 sills.

Contract was also entered into for 16 additional chess wagons to be delivered at an early date.

The following experimental items of bridge equipment were also purchased: One sectional steel ponton boat and one ponton tool wagon.

The army appropriation act of May 11, 1908, provided $72,500 for the engineer equipment of troops during the fiscal year ending June 30, 1909.

The expenditures from this fund will be made in accordance with estimates submitted to Congress.

At the rate permitted by past appropriations, the work of supplying the Army with engineer equipment will take several years for completion. In certain lines of material, definite amounts and specifications have now been adopted and will probably not be changed in the near future. In addition, there are many items of equipment, such as field searchlights, new forms of ponton material, traction for engineer pack trains, etc., on which much development is still needed. For all these reasons the estimates for the next fiscal year are increased to $90,000.

For details of expenditures under the appropriation for engineer equipment of troops see Appendixes 2, 3, and 4.

ENGINEER EQUIPMENT OF TROOPS, 1908.

Amount appropriated in the army appropriation act of March 2, 1907	$40,000.00	
Amount received during year by settlements and deposits in payment for property transferred, sold, and lost	1,166.15	
		$41,166.15
June 30, 1908, amount expended during fiscal year		24,073.29
July 1, 1908, balance unexpended		17,092.86
July 1, 1908, outstanding liabilities		17,082.46
Balance to revert to Treasury		10.40

CIVILIAN ASSISTANTS TO ENGINEER OFFICERS.

By act of Congress approved March 2, 1907, the sum of $25,000 was appropriated for civilian assistants to engineer officers serving on the staffs of division, corps, and department commanders, to enable them to secure the services of surveyors, draftsmen, photographers, master laborers, and clerks during the fiscal year 1908, and the same amount has been appropriated for the fiscal year 1909. These funds have been applied to the purpose for which appropriated; the sum of $24,285.22 was expended during the fiscal year 1908, and a balance of $714.78 reverted to the Treasury.

A marked increase in map work performed under the chief engineer officer, Philippines Division, made necessary a large allotment to that division of funds withdrawn from the various military departments in the United States, which caused embarrassment in the work of the chief engineer officers of military departments in the United States. Formerly there were only 5 offices, corresponding to the 5 chief engineer officers of geographical divisions. The abolishment of the United States geographical divisions and the creation of

9 military departments in lieu thereof has increased the number of chief engineer officers to 10, and an increase in the number of skilled surveyors and draftsmen has necessarily resulted.

Based upon reports received from these departments and the Philippines Division, it is estimated that $40,000 is the least amount which will enable the chief engineer officers to satisfactorily perform their duties, and an estimate of this amount is therefore submitted.

RIVER AND HARBOR IMPROVEMENTS.

Appropriations.—The funds with which the works for the improvement of rivers and harbors were prosecuted during the past fiscal year were derived from the appropriations made by the river and harbor act approved March 2, 1907, the sundry civil acts approved March 4, 1907, and May 27, 1908, from such appropriations as have been provided by other general acts and by special acts of Congress, and from the available balances of former appropriations.

The following works are provided for by permanent appropriations: Removing sunken vessels; operating and care of dredge boats on upper Mississippi River; removing obstructions in Mississippi River; gauging waters of the Mississippi River and its tributaries; examinations and surveys at South Pass, Mississippi River; maintenance of South Pass channel, Mississippi River; operating snag boats on Ohio River; operating and care of canals, etc.; support and maintenance of the Permanent International Commission of the Congresses of Navigation.

Status of works.—Statements derived from the reports of the officers in charge of the various works, and given herewith, set forth the condition of each improvement and the extent of the work performed during the past fiscal year.

Expenditures.—The total amount actually expended under the direction of the Chief of Engineers in connection with the improvement of rivers and harbors during the fiscal year ending June 30, 1908, is as follows:

Rivers and harbors (general, including examinations, surveys, and contingencies)	$23,398,969.23
Removing sunken vessels	50,380.08
Operating snag and dredge boats on upper Mississippi and Illinois rivers	25,000.00
Removing obstructions in Mississippi River	97,889.35
Gauging waters of the Mississippi River and its tributaries	9,251.10
Maintenance of South Pass channel, Mississippi River	132,194.39
Examinations and surveys at South Pass, Mississippi River	10,450.00
Operating snag boats on Ohio River	37,063.40
Operating and care of canals, etc	1,588,330.89
Prevention of deposits in New York Harbor	89,315.45
California Débris Commission (expenses)	14,426.96
Permanent International Commission of the Congresses of Navigation	1,554.50
International Waterways Commission	19,455.96
	25,474,281.31

This amount does not include the following:

Expenditures under Mississippi River Commission	$2,777,691.83
Enlargement of Governors Island, New York Harbor	172,827.57
Reclamation of Quarantine Island, Honolulu, Hawaii	3,628.46
Destruction of ice gorge in Missouri River	22.46
Piers, Hampton Roads, Jamestown Exposition	185,846.84
	8,140,017.18

Expenditures have also been made, as follows, from funds contributed by States, municipalities, and private parties:

Contributed by citizens of St. Joseph, Mo., for improvement of Missouri River	$6,840.69
Contributed by Twin City Rapid Transit Company and city of St. Paul, Minn., for construction of bridge over Mississippi River at Fort Snelling	24,961.12
Contributed by State of Washington for improvement of Snake River, Wash	47,377.31
Contributed by State of Washington for improvement of Columbia River above Celilo, Wash	13,159.66
Contributed by railroad companies for improvement of Missouri River at Elwood, Kans	36,679.69
Contributed by railroad companies and private interests for improvement of Puyallup Waterway, Tacoma, Wash	7,798.95
	136,817.42

Estimates.—The following estimates are submitted by the Chief of Engineers for the fiscal year ending June 30, 1910:

Under continuing contracts	$20,479,057
Rivers and harbors (general, including examinations, surveys, and contingencies)	21,464,141
Under California Débris Commission (expenses)	15,000
Prevention of deposits in New York Harbor	155,260
Enlargement of Governors Island, New York	75,000

In addition to the above, the Mississippi River Commission submits an estimate amounting to $3,000,000, reduced in this office to $2,000,000.

Engineer divisions.—The engineering works in charge of this office are arranged in divisions, and officers of the Corps of Engineers were assigned as division engineers to overlook these works, as follows:

East of the Rocky Mountains: Northeast Division, Col. John G. D. Knight; Eastern Division, Col. D. W. Lockwood; Gulf Division, Col. E. H. Ruffner; Central Division, Col. G. J. Lydecker to November 15, 1907, Col. Chas. E. L. B. Davis from November 15, 1907, to February 15, 1908, and Col. Wm. T. Rossell since February 15, 1908; Lakes Division, Lieut. Col. W. L. Fisk since February 15, 1908; Northwest Division, Col. W. H. Bixby to February 14, 1908; Western Division, Col. W. H. Bixby since February 15, 1908. West of the Rocky Mountains: Pacific Division, Lieut. Col. John Biddle; Northern Pacific Division, Lieut. Col. S. W. Roessler.

IMPROVEMENT OF RIVERS AND HARBORS IN THE PORTLAND, MAINE, DISTRICT.

This district was in the charge of Lieut. Col. Geo. A. Zinn, Corps of Engineers. Division engineer, Col. John G. D. Knight, Corps of Engineers.

1. Lubec Channel, Maine.—This channel lies between the eastern extremity of the State of Maine and Campobello Island, Canada.

Originally the depth was about 5 feet at mean low tide and 2 feet at low water of spring tides.

A project was adopted in 1879 which, as subsequently modified, provided for a channel 275 feet wide, increasing to 300 feet in the bends, and 12 feet deep at mean low tide. This project was completed in 1890, practically as proposed, at a cost of $168,954.68.

The present project was adopted August 18, 1894, and its object was to widen the then existing channel to a least width of 500 feet, at

an estimated cost of $150,000. The amount expended on the work of the existing project up to the close of the fiscal year ending June 30, 1908, was $138,478.30. At the latter date the channel had been dredged to the full projected width and depth contemplated by the project of 1894. The work will probably be reasonably permanent, but examinations will have to be made from time to time, when opportunity offers, to determine this question.

The maximum draft that can be carried is about 11.5 feet at mean low water; the mean variation in tide level is 18.2 feet. The channel, which is about 3 miles long, connects the roads above with the Atlantic Ocean, and is the convenient and direct approach to Lubec, Eastport, and St. Croix River from the westward. It is an international passage, and the benefits from the improvement are almost entirely general. As the tidal currents are very strong and dense fogs prevail a large part of the time, the widening of the passage decreases the chances of stranding and collision.

The commerce is reported as follows, in tons: 1898, 87,000; 1899, 126,700; 1900, 76,800; 1901, 165,000; 1902, 148,400; 1903, 127,000; 1904, 76,200; 1905, 86,000; 1906, 74,400; 1907, 65,950.

For reports on examinations and surveys see page 279, Annual Report of the Chief of Engineers for 1879, and page 616, report for 1891.

There were no expenditures during the fiscal year 1908.

July 1, 1907, balance unexpended	$11,567.02
July 1, 1908, balance unexpended	11,567.02

(See Appendix A 1.)

2. Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Me.—The object of the breakwater is to protect the wharves of Bar Harbor and the anchorage in front of the town from the heavy seas of southerly gales.

The present project is the original one, approved June 14, 1889, modified as to length of breakwater by the revised project of 1893. It provides for a breakwater of riprap stone, extending from Porcupine Island, a distance of 2,500 feet in a westerly direction, to a point about 600 feet from the low-water line of Mount Desert Island, the estimated cost being $420,200.

The expenditures to June 30, 1908, were $206,002.70.

By that date the breakwater had been raised to a height of mean high tide to a point about 1,859 feet from Porcupine Island. The width of top is 20 feet, and the side slopes are such as the rock naturally assumes—about 1 on 1. The estimate of cost was based on the expectation that 382,000 tons of stone would be required. Up to the present time 211,534 tons has been deposited.

The beneficial effects resulting from the portion of the breakwater already built in protecting the wharves at Bar Harbor and the anchorage basin, which is extensively used by costly pleasure craft during the summer season, are appreciably felt, but in order to secure the desired protection at high water of spring tides it may be found necessary to raise the breakwater to a height of about 6 feet above mean high tide. The mean range in tides is 11.5 feet.

The benefits to navigation are general in providing a harbor of refuge, and local in making it possible for boats to land at the

wharves at all times with safety. The only convenient method of transportation to and from Bar Harbor is by boat.

The commerce for 1907 is given as 47,352 tons, principally coal, wood, and general merchandise. The total number of passengers was 110,585, but this included those for other points in Frenchmans Bay, it not being practicable to separate them.

The new appropriation estimated for is to be applied in extending the breakwater, in accordance with the project.

For report on examination and survey, see Annual Report of the Chief of Engineers for 1887, page 481.

July 1, 1907, balance unexpended	$30,210.82
June 30, 1908, amount expended during fiscal year, for works of improvement	16,213.52
July 1, 1908, balance unexpended	13,997.30
July 1, 1908, outstanding liabilities	12,751.51
July 1, 1908, balance available	1,245.79
Amount (estimated) required for completion of existing project	200,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix A 2.).

3. Harbor at Sullivan Falls, Maine.—Sullivan River has a length of about 6 miles and is the outlet of a large bay. About midway of its length a point of land projects to such extent as to reduce the width to about one-fourth that immediately above and below, and at this place the slope and velocity are such that the locality is termed "Sullivan Falls." The bottom is ledge, the higher portions forming dangerous obstructions to navigation. Hatchers rock, about midway of the narrow channel at the falls, had originally only about 6 inches of water over it at mean low tide. The mean range in tides is 11.5 feet.

Under a project set forth in report of the district engineer dated December 10, 1870, and under appropriations based thereon, the sum of $35,000 was expended in removing three old piers, in excavating the obstructing ledges at the falls to a depth of 7 feet at mean low tide, and in replacing spindles on two rocks near the mouth of the river. This work was completed in 1875 and was of material benefit to navigation.

The present project is that referred to in the river and harbor act of June 3, 1896, as the "approved project," and published in the Annual Report of the Chief of Engineers for 1891, page 619. It provides for removing Hatchers rock and two other points of ledge to a depth of 10 feet at mean low tide, at an estimated cost of $35,000.

The expenditures under the existing project to June 30, 1908, were $14,870.64, and the operations consisted in removing the entire area of Hatchers rock and about five-sixths of ledge "C" to a depth of 10 feet at mean low tide. About 70 per cent of the work covered by the project has been completed.

To complete the present project the remaining part of ledge "C," containing about 67 cubic yards in situ, and ledge "B," containing 255.3 cubic yards in situ, will have to be removed.

The improvement not only increases the navigable depth, but also, by removing the cause of eddies and cross currents, has added to the length of time at each high and low tide during which vessels may pass through the rapids with safety.

Vessels can not use the channel at low stages except when the tide is slack. This occurs after the tide has flowed about 2 feet, at which time vessels drawing 11 feet can pass through safely.

The improvement may be regarded as permanent.

The commerce for five years was as follows, in tons: 1902, 37,050; 1903, 45,700; 1904, 31,400; 1905, 42,100; 1906, 29,450. No statistics could be obtained for 1907.

The commerce consists almost entirely of granite.

It is proposed to apply the new appropriation estimated for in continuing the rock excavation in accordance with the project.

For reports on examinations and surveys, see Annual Report of the Chief of Engineers for 1871, page 836; and page 619, report for 1891.

July 1, 1907, balance unexpended	$129.36
July 1, 1908, balance unexpended	129.36
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	10,000.00

(See Appendix A 3.)

4. Union River, Maine.—The navigable portion of the river extends from the head of Union Bay to the foot of the falls at Ellsworth, a distance of about 3¾ miles.

Before improvement the channel was obstructed by a large deposit of slabs, edgings, and sawdust near Ellsworth, which practically suspended navigation except at high tide, by projecting ledges in the Narrows about three-fourths of a mile below the wharves at Ellsworth, by bowlders at several points along the channel, and by a broad, flat bar of sawdust and mud at the mouth.

The first project for the improvement of the river is contained in the report of the district officer dated June 30, 1867, and provided for erecting beacons, removing sunken ledges and bowlders, and dredging mill waste near Ellsworth, so as to secure a depth of 3 feet at mean low tide, this being the available depth on the bar at the mouth of the river. This improvement was completed in 1873 with an expenditure of $30,000.

A survey was made in 1889 under the provisions of the act of 1888, and a new project was submitted with a view to obtaining a depth of 6 feet at mean low tide from the wharves at Ellsworth to deep water in the bay. This depth was to be obtained by dredging mill waste near Ellsworth, by removal of ledge in the Narrows, and by dredging across the bar at the mouth of the river. To maintain the improved depth at the latter point the same project provided for the construction of a training wall to concentrate the ebb flow in the channel. The project is described on page 462, Part 1, Annual Report of the Chief of Engineers for 1890.

The act of June 3, 1896, appropriated $15,000 for beginning the improvement. This sum was expended in excavating to a depth of about 6 feet over a section of river about 3,000 feet long in the vicinity of the Narrows, and in carrying a single cut of the dredge to the same depth as far up as the wharves, to afford immediate relief to navigation. This single cut was partly filled with new deposit by the next freshet.

By the act of March 3, 1899, the sum of $15,000 was appropriated and a contract was authorized for completing the improvement, at an additional cost of $115,000.

Changes having occurred since the making of the survey upon which the project was based, a new survey was made in May, 1899, and a project for securing the completion of the improvement, with such changes in quantities as were shown to be necessary by the survey, was approved by the Secretary of War June 28, 1899.

This project, with some further modifications, was completed in 1902. The dredging at the mouth of the river and the removal of the ledge in the Narrows were accomplished, and the channel at Ellsworth, where the material was sawmill waste, was dredged, but the depth at the latter place was not expected to maintain because of the movement during freshets of material from the great deposits of mill waste at that locality.

The expenditures to June 30, 1908, in connection with the last project have been $142,487.35, of which amount $385.99 was used during the past fiscal year in making a somewhat extended examination of the improvement. The officer in charge reports that some shoaling has occurred at the mouth of the river and in a greater degree at Ellsworth, and submits an estimate of $15,950 for restoration or maintenance of the improvement.

The mean range in tide is 11.5 feet.

The commerce for 1907 is given as 15,395 tons, chiefly lumber, cement and lime, and coal, with an estimated value of $102,000.

For reports on examination and surveys, see Annual Reports of the Chief of Engineers for 1867, page 501; 1890, page 458; 1897, page 800; 1898, page 839; and 1899, page 1026.

July 1, 1907, balance unexpended	$2,898.64
June 30, 1908, amount expended during fiscal year, for maintenance of improvement	385.99
July 1, 1908, balance unexpended	2,512.65
July 1, 1908, outstanding liabilities	79.05
July 1, 1908, balance available	2,433.60
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	15,950.00

(See Appendix A 4.)

5. Bagaduce River, Maine.—This is a small stream that empties into Penobscot Bay at Castine, Me. The upper part of the river divides into two branches, one called Northern Bay and the other South Bay. Northern Bay, near South Penobscot, is a shoal sheet of water of about 700 acres area, the bottom of which for the greater

part is bare at low tide. Before improvement there was a narrow channel from Bridges Point to Bowden's wharf, which had a depth of less than 2 feet and was obstructed by ledges and bowlders near Winslows Island. The South Bay is obstructed by ledges at Johnsons Narrows. Mean rise and fall of tide, 9.8 feet.

The approved project is understood to be that published at page 398 of the Annual Report of the Chief of Engineers for 1888. Its object is to secure a channel 100 feet wide and 6 feet deep at mean low tide from Bridges Point, Northern Bay, to Bowden's wharf, at an estimated cost of $45,000. The same project provides for removing a small quantity of rock in the channel at Johnsons Narrows, at an estimated cost of $1,875. All work done has been in accordance with this project. About one-third of the work covered by the project may be said to have been completed.

The expenditures to June 30, 1908, were $28,000. At that date there had been made, by dredging and the removal of rocks and bowlders, a channel 40 feet wide and 6 feet deep at mean low tide, except at Winslows Island, where a depth of only 4 feet has been secured. The total length of channel is about 4,000 feet.

The improvement has been regarded as of doubtful public value, and it is only recently that any use has apparently been made of the dredged channel. A small power boat now makes regular trips from Castine, carrying passengers and freight.

For reports on examinations and surveys, see Annual Reports of the Chief of Engineers for 1888, page 398; 1893, page 724; and 1898, page 842.

The new appropriation recommended is for continuing the excavation of the channel at Winslows Island.

The tonnage for 1907 is given as 122,395 tons, but this includes the business of Castine, at the mouth of the river. The commerce of the Bagaduce proper is put at about 29,000 tons, with an estimated value of about $213,000.

Amount (estimated) required for completion of existing project	$18,875.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	5,000.00

(See Appendix A 5.)

6. Penobscot River, Maine.—Except the dredging of a sawdust bar opposite High Head, near Bucksport, Me., the improvements have been confined to a stretch of about 3½ miles of the river at and below Bangor. Before improvement this part of the river was obstructed by ledge, bowlders, and mill waste to such extent as to afford a safe available depth of only about 6 feet at extreme low tide. The mean range in tides is 13.1 feet.

The head of navigation is at Bangor; from thence to the head of the bay is about 27 miles.

The first project was approved August 22, 1870, and called for a depth of 12 feet at lowest tides for a width of 150 feet over 3½ miles of river at and below Bangor. There was expended $198,300.

After a survey, ordered by the act of September 19, 1890, the project was modified and extended to include a depth of 11 feet at extreme low tide for a width of 360 feet in Bangor Harbor; to widen,

straighten, and deepen the channel near Crosbys Narrows and Sterns's mill to a depth of 12 feet at extreme low tide, and to secure a depth of 22 feet at mean low tide between Bucksport and Winterport, at an estimated cost of $440,000. March 3, 1899, the project was again extended by providing for removal of ledge in front of the Boston and Bangor Steamboat Company's wharf at Bangor and for deepening the basin of Kenduskeag stream at its junction with the Penobscot, and $28,000 was appropriated for the work. The results contemplated under these appropriations are regarded as practically accomplished.

By the act of March 2, 1907, Congress adopted a further project for an additional width at Bangor, varying from 100 to 300 feet for a length of nearly 2,000 feet, the depth to be 11 feet at extreme low tide (14 feet at mean low water). The estimated cost of this work is $130,000.

The expenditures under the modified and enlarged project (since 1890) have been $170,608.69, and the object of the projects has been virtually secured down to that of March 2, 1907, though all the work estimated for has not been carried out.

The available depths are as follows: Bangor Harbor, 14 feet at mean low tide or 11 feet at extreme low tide; at Sterns's mill and Crosbys Narrows, 15 feet at mean low tide or 12 feet at extreme low tide. The shoal at Frankfort flats was dredged to 22 feet at mean low tide and, so far as known, has given no trouble since. At High Head, above Bucksport, the material is soft and shifting; no permanent good can be accomplished by dredging, and, as the shoal is not dangerous, no further work is recommended.

No work was done during the fiscal year 1908. Proposals were opened May 7, 1908, but the prices were regarded as excessive and the work is to be readvertised.

The project for widening the channel at Bangor, adopted in 1907, is to satisfy a demand for an increase in harbor capacity.

For list of examinations and reports, see Annual Report of the Chief of Engineers for 1906, page 25. The existing project for additional width at Bangor is printed in House Document No. 739, Fifty-ninth Congress, first session.

The tonnage for 1907 is given as 451,806 tons, of which about 258,000 tons was coal, and about 103,000 tons lumber. A conservative estimate of the value of the commodities is $2,480,411.20.

GENERAL IMPROVEMENT.

July 1, 1907, balance unexpended	$8,500.00
July 1, 1908, balance unexpended	8,500.00

AT BANGOR.

July 1, 1907, balance unexpended	$130,000.00
June 30, 1908, amount expended during fiscal year, for works of improvement	1,108.69
July 1, 1908, balance unexpended	128,891.31

(See Appendix A 6.)

7. *Rockland Harbor, Maine.*—The wharves are located on the shores of three coves, formed by two projecting points of land on the western side of the harbor, known as Crocketts Point and Atlantic

Point. The general direction of the wharf frontage is north and south, and the length of frontage is about 800 feet. Before improvement depths in front of the wharves increased very slowly. All the wharves except those at the end of Crocketts Point and Atlantic Point extended only a short distance beyond the low-water contour, a high mean range in tide, which at this point is 9.6 feet, being relied upon to give access to moderate and light draft vessels at high tides. The entrance to the harbor from the east has a width of about 9,000 feet.

Before improvement the anchorage in front of the wharves, vessels lying at the wharves, and the wharves themselves were endangered by heavy seas during easterly gales.

The first improvement undertaken was to render it a safe harbor of refuge for coastwise shipping, and incidentally also to protect the wharves as far as possible from heavy seas. To accomplish this a project was adopted in 1881 in which two breakwaters were contemplated, one extending south from Jamesons Point, the other a detached breakwater nearer to and opposite the principal wharves in the town; both to be raised in the first instance to the level of mean tide, but with the expectation that a further raising would be necessary as experience might dictate.

In 1886 this project was amended so as to raise the height of the breakwater at Jamesons Point to the level of mean high tide. In 1890 it was again amended so as to eliminate the detached breakwater and to provide for extending farther south than was first contemplated the breakwater at Jamesons Point.

By the act of June 3, 1896, Congress adopted a project for dredging the inner harbor in the vicinity of the wharves to depths ranging from 4 feet to 13 feet at mean low tide and for removing two dangerous ledges, one occupying a central position in the harbor, which was to be cut down to the depth of 22 feet at mean low tide; the other, less centrally located, was to be removed to a depth of 14 feet. The estimated cost was $403,000. By the same act this project was combined with that for the breakwater as one project, and authority was given for completing the whole under the continuous-contract system, at an estimated expenditure of $1,036,000.

The dredging was finished in May, 1901; the removal of ledge in the fall of 1901. The breakwater was also completed to the height and slopes contemplated before the close of the same season. The sea slope of the breakwater did not maintain its status under the heavy winter gales and ice, and during the succeeding four years 52,372 tons of heavy riprap was placed on it. This was for improvement rather than maintenance, as it was to be expected that some work would be necessary from time to time until the slopes assumed a state of rest.

The total expenditures to the close of the fiscal year 1908 were $920,025.79. The benefits resulting are that the breakwater affords a safe and extensive anchorage and harbor of refuge. The removal of ledges has increased the available anchorage area, and the dredging affords access to the wharves by vessels of greater draft.

The project is regarded as completed, subject to any work that may be needed from time to time until the slopes of the breakwater have assumed a condition of permanence.

For reports on examinations and surveys, see Annual Report of the Chief of Engineers for 1893, page 729, and report for 1896, page 581.

The business for 1907 was 556,250 tons, of which 115,000 tons was coal, and 250,000 tons lime. The value of the commodities is estimated as $2,580,214.

The direct effect on freight rates can not be definitely stated, but the improvement has provided a commodious harbor of refuge, in addition to keeping pace with the local demand for better facilities.

July 1, 1907, balance unexpended	$5,474.21
July 1, 1908, balance unexpended	5,474.21

(See Appendix A 7.)

8. Sasanoa River, Maine.—Originally this stream was much obstructed in the vicinity of Upper Hell Gate. The channel at and near that place was crooked and narrow, and was obstructed by dangerous ledges, the shoalest of which had not more than 3 feet of water over it at mean low tide.

Between 1870 and 1881 the sum of $45,500 was appropriated, and the navigation was much improved by rock excavation, dredging, and the construction of a small jetty.

By act of June 3, 1896, a new project was adopted for widening the channel at Upper Hell Gate to 125 feet, with a depth of 12 feet at mean low tide, by ledge excavation; for dredging to the same depth at Carletons ledges, and for constructing a small jetty at the Camp Ground, at an estimated cost of $19,000, which amount was appropriated by the same act. This project was completed in 1898 at a cost of $11,987.69.

The present project submitted by the Board of Engineers for Rivers and Harbors, February 7, 1907, is to increase to a width of not less than 140 feet the channel 90 feet wide made under the first project through the ledges southeastwardly of Upper Hell Gate, and to remove Flat rock, all to the depth of 12 feet at mean low tide. This project was adopted by the act of March 2, 1907, which contained an appropriation of the entire estimated cost, viz, $44,000.

The expenditures under the existing project to June 30, 1908, have been $6,230.87. The work has been placed under contract and about one-fourth of the ledge excavation has been accomplished.

The Sasanoa is a tidal river or thoroughfare about 9 miles in length, connecting the Kennebec River at Bath, Me., with Sheepscot River. It is navigable throughout its entire length, and has about 12 feet depth at mean low tide over the shoalest parts. The mean range of tide in the vicinity of the proposed improvement is about 8.5 feet.

The business for 1907 is given as 3,161 tons, having an estimated value of about $125,000. The number of passengers carried was 68,616.

The effect on freight rates can not be stated in a definite way, but the improvement permits the use of larger vessels necessary to accommodate the increasing travel and renders the passage less dangerous.

For reports on examinations and surveys, see Annual Reports of the Chief of Engineers for 1867, page 499; 1895, page 593; for map, report for 1880, page 334.

July 1, 1907, balance unexpended	$43,541.95
June 30, 1908, amount expended during fiscal year, for works of improvement	5,772.82
July 1, 1908, balance unexpended	37,769.13
July 1, 1908, outstanding liabilities	4,926.07
July 1, 1908, balance available	32,843.06
July 1, 1908, amount covered by uncompleted contracts	19,570.00

(See Appendix A 8.)

9. Kennebec River, Maine.—Before improvement the main channel of the river between the foot of Swan Island and Gardiner was obstructed by shoals near Beef rock, with only 10 feet of water at mean low tide, by dangerous sunken ledges in Lovejoy Narrows, by a shoal below South Gardiner, with only 8 feet on it at mean low tide, and by a ledge at Nehumkeg Island. The steamboat channel to the west of Swan Island (at Hatchs rock) was obstructed by a shoal over which there was only 7½ feet of water, and the channel between Gardiner and Augusta, a distance of 6½ miles, was obstructed by shoals which gave a navigable depth of only 3½ feet in low summer tides.

Appropriations for minor improvements were made at various times between 1827 and 1852.

In 1866 a project was begun for improving the upper part of the river, with a view to obtaining a channel 7 feet deep and 100 feet wide at low water. This project, with modifications, was completed in 1877, and resulted in obtaining a channel 10 feet deep at mean low tide and not less than 100 feet wide in its lowest summer stages as far up as Gardiner, and a depth of 6½ feet at low tide and width of 100 feet from Gardiner to Augusta.

The channel west of Swan Island, being obstructed by shoal water (8½ feet at mean low tide) and a too narrow channel at the head of the island, by shoal water at Hatchs rock, below Richmond, and by a very narrow channel 30 feet wide at the foot of the island, was improved by dredging in 1881–1883, so as to give a channel 175 feet wide and 11 feet deep at the foot of the island and a channel of about 80 feet width and 10 feet depth at Hatchs rock and the head of the island.

The river and harbor act of 1886 provided for a new survey of the river from Bath to Augusta. This survey was made in 1887, and a project embracing dredging, rock excavation, and contraction works was submitted for the further improvement of the river. In 1892 this project was revised to secure depths as follows: Thirteen feet at mean low tide as far up as Sands Island, 12 feet thence to Hinckleys shoal, above Gardiner, and 10 feet thence to Augusta, at an estimate cost of $388,500. This project was approved August 19, 1892, and was essentially completed in 1898.

The total expenditures upon the river to June 30, 1908, under the projects above enumerated, were $487,850.

The improved channel obtained under the above projects has suffered some loss of available depth by the deposits brought down by freshets. This shoaling has been most marked in the stretch of 6½ miles of river between Gardiner and Augusta, the further improve-

ment of which is provided for by the river and harbor act approved June 13, 1902, which appropriated $40,000 and authorized a continuous contract for the completion of the project. The last project is published at page 1121 of the Annual Report of the Chief of Engineers for 1900, and proposes a widening of the channel from Gardiner to Augusta to 125 feet and a cleaning out of the old dredged channel and its further deepening to 16 feet at mean high water, or 11 feet at mean low water.

The expenditures under the project of 1902 have been $44,308.70. All the work covered by the project is under contract and about 66 per cent of it has been accomplished. The total estimated amount ($81,000) to complete the project has been appropriated. It is proposed to continue work under the present contract until the project is completed.

A project for improvement between the mouth and Gardiner was adopted by the river and harbor act of March 2, 1907, and is designed to obtain, by dredging and ledge excavation, channels through the shoals between the foot of Swan Island and Gardiner at least 150 feet wide and of such depths that for a vessel passing up the river at the usual speed on the flood tide and timed to reach Gardiner at high water the available depth would at no point be less than 20.5 feet. The depth over ledge is to be 1 foot greater than this. Two training walls are to be repaired and one of them lengthened 700 feet. The cost of the project is estimated at $275,000.

The act placed the project under the continuous-contract system. Appropriations amounting to $161,500 have been made, leaving $113,500 yet to be supplied. Expenditures under this project have been $10,554.95. Contracts have been made for the dredging and jetty work, leaving the ledge excavation yet to be provided for. Rather more than one-third of the work on the jetties has been accomplished, and the dredging has been commenced.

It is proposed to apply the new appropriation asked for in continuing the improvement of the river from the mouth to Gardiner. While some advantage will be had from increased depths as the work advances, no important measure of relief can be expected from the dredging until all the shoals have been cut through.

The mean rise and fall of tides at Bath is 6.9 feet; at Gardiner 5.1 feet; at Augusta 4.3 feet. Augusta is the head of navigation and is about 44 miles above the mouth of the river. Probably not more than 7 feet at mean low tide could be carried up from Gardiner to Augusta, which is the shoalest part of the stream.

For reports on examinations and surveys see Annual Reports of the Chief of Engineers for 1867, page 488; 1881, page 479; 1888, page 412; 1892, page 541, and 1900, page 1121, and House Document No. 321, Fifty-ninth Congress, second session.

The commerce for 1907 amounted to 329,582 tons, the value of which has been estimated at $1,523,691. These statistics show a marked decrease for the year in ice and lumber. But little ice was cut during the winter 1907–8.

While the use of the river for transportation purposes has some value in a competitive way, the principal effect on freight rates is due to the increased depths, permitting the use of larger vessels for

handling such commodities as coal, ice, and lumber, which demand cheap transportation.

GENERAL IMPROVEMENT.

July 1, 1907, balance unexpended	$12,500.00
July 1, 1908, balance unexpended	12,500.00

BETWEEN GARDINER AND AUGUSTA.

July 1, 1907, balance unexpended	62,910.65
June 30, 1908, amount expended during fiscal year for works of improvement	26,219.35
July 1, 1908, balance unexpended	36,691.30
July 1, 1908, outstanding liabilities	10,593.12
July 1, 1908, balance available	26,098.18
July 1, 1908, amount covered by uncompleted contracts	25,994.84

FROM THE MOUTH TO GARDINER.

July 1, 1907, balance unexpended	74,996.29
Amount appropriated by sundry civil act approved May 27, 1908	86,500.00
	161,496.29
June 30, 1908, amount expended during fiscal year for works of improvement	10,551.24
July 1, 1908, balance unexpended	150,945.05
July 1, 1908, outstanding liabilities	11,116.47
July 1, 1908, balance available	139,828.58
July 1, 1908, amount covered by uncompleted contracts	168,506.51
Amount (estimated) required for completion of existing project	113,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	113,500.00

(See Appendix A 9.)

10. Portland Harbor, Maine.—The entrance to the main part of the harbor of Portland, or the anchorage, has always been good, but before improvement the approach to the inner harbor was obstructed by a shoal known as the Middle Ground, over which the depth was only from 8 to 10 feet at mean low tide, while between it and Stamford ledge the greatest available depth was only 16 feet. The best part of the wharf front was exposed to swell from the main entrance, which sometimes made it dangerous for vessels to lie at the docks, and along this front the depth was in some places as shallow as 4 feet.

The first work of improvement undertaken by the Government was the construction of the breakwater. This was begun as early as 1836. It was completed in 1874.

The work of deepening the harbor was begun under the act of Congress of 1868, the plan of improvement being to excavate a channel 300 feet wide and 20 feet deep at mean low tide through the southern slope of the Middle Ground and to remove the bar off the Grand Trunk Railroad wharves to the same depth.

The project was modified in 1870 so as to provide for a channel 400 feet wide, and again in 1871 so as to provide for a channel 500 feet wide. In 1872 further modifications were made by including in the project the dredging of Back Cove and the dredging of the inner harbor up to the harbor commissioner's lines to a depth of 16 feet at mean low tide. The project, modified as above described, excepting some dredging in the inner harbor, was completed by 1876. Between 1881 and 1885 the Middle Ground was removed to a depth of 21 feet at mean low tide.

A further deepening of a portion of the harbor to 29 feet at mean low tide was next begun under the project of 1886. To this was subsequently added, in 1890, a small amount of dredging in the upper part of the harbor.

In 1894 the project was extended to cover the widening of the upper part of the 29-foot area and the dredging of a channel 25 feet deep to connect the deep water in the lower part of the harbor with deep water in the upper part. This work was completed in 1894.

By the act of June 3, 1896, Congress adopted a project for dredging to 30 feet at mean low tide over the greater part of the harbor, at an estimated cost of $770,000, and included in the project the further improvement of Back Cove at a combined estimate of $946,250. The same act appropriated $20,000 for beginning work, and authorized the making of a contract for its completion.

The latter project was completed in 1902, at a cost which was about $253,000 less than the estimate. By the sundry civil act of March 3, 1905, Congress authorized an amendment to the project by which the 30-foot channel is to be continued up Fore River as far as the Boston and Maine Railroad bridge, a channel of entrance to Back Cove dredged to the same depth, the width in each case to be about 300 feet, and a small area on the south side of the harbor, in front of the old dry dock, also to be dredged.

The total expenditures up to the close of the fiscal year ending June 30, 1908, have been $1,480,501.75—$576,477.05 under former projects and $904,024.70 under the existing one. The various projects have been completed excepting the amendment of 1905, under which work was commenced the last day of October, 1905, and which is due to be finished probably within six weeks, the only work remaining to be done being at the upper end of the Fore River channel at and above Vaughan bridge.

There are no silt-bearing streams emptying into Portland Harbor, and the improved depths obtained under the project will be practically permanent. The maximum draft that can be carried to the wharves in Portland Harbor at mean low tide is 30 feet and to the wharves in Back Cove about 11 feet. The mean range in tide is 8.8 feet.

Two principal advantages have followed this large improvement. A large and well-sheltered deep-water anchorage has been created under the shelter of the breakwater, and the trans-Atlantic vessels can arrive and depart from their docks at the lowest stages of tide.

The portion of the harbor in which most of the dredging has been done is the lower part of so-called Fore River. This river is crossed by four bridges. Going up the harbor these are: (1) Portland bridge; (2) bridge of the Boston and Maine Railroad, Eastern Division; (3) Vaughan bridge, belonging to city; (4) bridge of Boston

and Maine Railroad, Western Division. Portland bridge has a draw 65 feet wide and admits vessels of the largest class coming to Portland. The next bridge has recently been reconstructed, with a draw opening of 60 feet, and the city of Portland has about completed the reconstruction of the third bridge, with an opening of not less than 60 feet. The improvement in the bridges and the new channels will afford great relief to the coal trade and other deep-draft commerce, which has been much hampered and retarded by lack of room and sufficient water.

For reports on examinations and surveys, see Annual Reports of the Chief of Engineers for 1886, page 541; 1893, page 735; 1901, page 1009, and House Document No. 445, Fifty-ninth Congress, first session.

The commerce for 1907 is given as 3,246,863 tons, of which more than one-half was coal. It is impracticable to make an accurate statement as to the value of these commodities, but a conservative estimate places it at $36,719,676.60.

It is impracticable to make a definite statement as to the effect of the improvement on freight rates, but a large trans-Atlantic business has been greatly helped, and the capacity of the harbor has kept pace with the increase in size and draft of vessels used in the coal traffic, with the accompanying saving in cost of transportation.

July 1, 1907, balance unexpended	$130,283.35
Received from sales	3.00
	130,286.35
June 30, 1908, amount expended during fiscal year for works of improvement	88,058.05
July 1, 1908, balance unexpended	42,228.30
July 1, 1908, outstanding liabilities	20,770.80
July 1, 1908, balance available	21,457.50
July 1, 1908, amount covered by uncompleted contracts	4,050.00

(See Appendix A 10.)

11. Saco River, Maine.—In its original condition Saco River had a very winding course with abrupt bends and narrows, which, with its sunken rocks and ledges, presented many difficulties of navigation. The depth on the bar was only 2 feet at mean low water.

The original projects appear to have been—

(1) From 1824 to 1827, for the erection of piers, placing beacons and buoys, and removing obstructions near the entrance to the harbor. Under this project 12 piers of timber and stone were built, 10 in the river to mark sunken rocks and to facilitate navigation by sailing vessels, and 2 outside the mouth designed, but without success, to create a channel through the bar. The construction and maintenance of these works cost, 1824–1827, $12,000.

(2) Adopted by the act of June 23, 1866, to construct a breakwater 2,915 feet long connecting the two outside piers, and to repair the river piers and improve the channel. Under this project, completed in 1874, the channel in the river and through the bar was improved, and a breakwater built on the north side of the channel 4,200 feet long and 10 feet high above mean low water, at an expense of $162,271.75.

The existing project is the consolidation by the act of September 19, 1890, of the project adopted in 1884 for repairing the breakwater, extending it 2,200 feet to Sharps ledge, building a stone jetty on the south side of the channel, and dredging between the jetties, at an estimated cost of $356,500; and the project adopted in 1886 for improving the river to Saco, 5 miles above its mouth, to the depth of 6 feet at mean low water, estimated to cost $50,000, amounting to $406,500. About 43 per cent of this project has been completed, i. e., all except the extension of the breakwater to Sharps ledge, which is estimated to cost $200,000 and upon which no work has been done. In order to maintain the desired depth the extension of this breakwater will be necessary to stop the influx of sand from the north. Possibly the full extension proposed will not be required.

On June 30, 1908, there had been expended on this consolidated project $172,258.37. An examination made in 1900 showed that 3½ feet at mean low water was the maximum draft that could then be carried over the bar, the shoalest part of the locality under improvement. No examination has since been made from which the depth can be given to June 30, 1908.

The mean range of tides is 8.8 feet.

The head of navigation is at Saco and Biddeford, on opposite sides of the river, to which towns, about 5 miles above the bar, the river is navigable in fact.

The commerce for 1907 amounted to 46,120 tons, principally coal, of an estimated value of $242,679.

A description of the harbor and of the earliest improvements is published in the Annual Report of the Chief of Engineers for 1866, page 188. The present project for improvement at the river's mouth is published in the report for 1884, page 484, and for improving the river above the bar in the report for 1886, page 552.

It is proposed to apply the available balance and the appropriation recommended to extending the breakwater toward Sharps ledge.

July 1, 1907, balance unexpended	$5,241.63
July 1, 1908, balance unexpended	5,241.63
Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	40,000.00

(See Appendix A 11.)

12. Cape Porpoise Harbor, Maine.—Originally the harbor had a depth of about 13 feet at mean low tide, but for a small area only, and the entrance was obstructed by a bar on which there was only about 10 feet of water at mean low tide. The anchorage was too small to accommodate the craft seeking the harbor for refuge only, aside from the local commerce.

Under a project adopted March 3, 1899, a channel of entrance 200 feet wide and 16 feet deep at mean low tide and an anchorage area about 3,000 feet long, 600 feet wide, and 15 feet deep at mean low tide were secured by the close of the fiscal year 1902, under an outlay of $72,501.15.

The present project, adopted by the act of March 2, 1907, aims to deepen and straighten the outer entrance channel, which is narrow and crooked, so as to give a width of 200 feet and a depth of 18 feet at mean low tide. The estimated cost is $46,000, and the full amount was appropriated by the act of 1907.

The amount expended on the project of 1907 to the close of the fiscal year is $1,563.43. The work, which consists in excavating about 4,200 cubic yards of rock, has been placed under contract, and about 80 per cent of the area has been drilled and blasted, but none of the loosened material has yet been taken up.

The mean range of tide is about 8.8 feet.

The commerce for 1907 is given as 50,491 tons, the chief items being bricks, clay, and coal. The value is placed at $157,369.

While the improvement may incidentally have an effect on freight rates, the principal benefit consists in straightening and making easier a crooked entrance, difficult and dangerous in fog and storm.

For reports on examinations and surveys see Annual Reports of the Chief of Engineers for 1895, page 583; for 1899, page 1050, and House Document No. 191, Fifty-ninth Congress, first session.

July 1, 1907, balance unexpended	[a]$45,925.80
June 30, 1908, amount expended during fiscal year for works of improvement	1,489.23
July 1, 1908, balance unexpended	44,436.57
July 1, 1908, outstanding liabilities	75.00
July 1, 1908, balance available	44,361.57
July 1, 1908, amount covered by uncompleted contracts	40,569.60

(See Appendix A 12.)

13. Harbor at Isles of Shoals, Maine.—The most protected anchorage at Isles of Shoals, known as Gosport Harbor, lies between Star Island on the south and southwest, Cedar Island on the southeast, and Smuttynose Island on the north and northeast. At mean low water its anchorage of about 32 acres had a depth of 18 to 48 feet and none of its entrances less than 24 feet.

The original project of March 3, 1821, appears to have been to rebuild the small breakwater on the north side of Haleys Cove, projecting westerly from Smuttynose Island to Cedar Island, directly protecting Gosport Harbor from easterly storms.

The amount expended on the original project prior to operations under the existing project was $13,251.61.

The existing project, adopted by the act of June 13, 1902, is to construct a breakwater on the base of the breakwater that was built under the project of 1821 between Smuttynose and Cedar islands, the upper part of which throughout its length had been demolished down to the level of 1½ feet above mean low water, at an estimated cost of $30,000.

The amount expended on the work of the existing project to June 30, 1908, is $28,201.60, all for improvement, with which the breakwater between Smuttynose and Cedar islands has been completed to the height of 15 feet above mean low water, completing the project.

The mean range of tides is 8.6 feet.

[a] There is a balance of appropriation of June 6, 1900, amounting to $7,498.85 not considered applicable under existing project.

The commerce benefited by the improvement is inconsiderable, but the harbor is of value as a harbor of refuge in the open sea 6 miles off the coast.

The tonnage for 1907 is given as 1,938 tons, of an estimated value of $50,188.50.

A report of a survey of the Smuttynose Island breakwater is published in the Annual Report, Chief of Engineers, for 1875, Part 2, page 421. A description of the harbor, with survey and estimate for the new breakwater, is in the Annual Report for 1900, page 1172.

July 1, 1907, balance unexpended	$1,798.40
July 1, 1908, balance unexpended	1,798.40

(See Appendix A 13.)

14. Cocheco River, New Hampshire.—Appropriations amounting to $10,060, made from 1829 to 1837, inclusive, had been applied to the reduction of obstructions in the natural channel prior to the systematic improvement of this river, begun in 1870, when it was found to have a good channel not less than 6 feet deep at mean low water from its confluence with the Piscataqua River to the Lower Narrows, about 1½ miles below the lowest bridge at Dover. Above the Lower Narrows the channel was obstructed by ledges and shoals upon which at mean low water the depth was from 6 inches to 2 feet. The original project for systematic improvement, adopted by the act of March 3, 1871, was to obtain a channel 40 feet wide and 4 feet deep at mean low water from the Lower Narrows to the head of navigation at Dover. Under the original and amended projects completed in 1888 the amount expended prior to operations under the existing project, including the expenditures from 1829 to 1837, was $170,060.

The existing project, adopted by the act of September 19, 1890, is to obtain a channel 60 to 75 feet wide and 7 feet deep at mean low water (in rock 50 feet wide and 7½ feet deep) from the mouth of the river to the head of navigation, at an estimated cost of $175,000. By the act of June 13, 1902, this project was extended to include the restoration of the channel in the Lamprey River, which, from 1881–1883, under specific appropriations, had been dredged at mean high water 100 feet wide and 12 feet deep to the Lower Narrows and 40 feet wide and 11 feet deep to the wharves at Newmarket, N. H.

To June 30, 1908, there has been expended on the existing project for improving Cocheco River, $137,000, as follows: Cocheco River, for improvement, $119,089.93; for maintenance, $9,642.54; for Lamprey River, for maintenance, $8,267.53. As a result the channel in Cocheco River has been completed except over a small portion about 3,500 feet below Dover, where some additional ledge excavation may be necessary, the basin at Dover and the channel near the mouth, where shoaling had occurred, have been redredged, and the channel in Lamprey River has been restored to the full authorized dimensions.

The maximum draft that can be carried in Cocheco River is 6½ feet at mean low tide, and in Lamprey River 11 feet at high tide.

The mean range of tide is 6.8 feet.

The head of navigation is at the lowest bridge in Dover, to which point, 3 miles from its confluence with the Piscataqua River and 13 miles from the sea, the Cocheco River is navigable in fact.

The commerce for 1907 amounted to 214,300 tons, roughly valued at $1,036,450. Definite figures as to the effect on freight rates brought

about by the work of improvement can not be given, but great advantage has been derived, particularly in the coal trade, through the employment of somewhat larger vessels and the existence of competitive water transportation.

The original project, adopted in 1871, is published in the Annual Report of the Chief of Engineers for 1871, page 858; the existing project, adopted in 1890, in the Annual Report for 1890, page 475. A map of Cocheco River in the vicinity of Dover may be found in the Annual Report for 1885, page 474.

July 1, 1907, balance unexpended	$4,711.00
July 1, 1908, balance unexpended	4,711.00

(See Appendix A 14.)

15. Harbor of refuge at Little Harbor, New Hampshire.—In its original condition the entrance to Little Harbor was but 3 feet deep at mean low water, and its anchorage ground, 650 by 125 feet in area and 9 feet in depth at mean low water, was exposed to the full force of the sea.

The original, which is also the existing, project, adopted by the act of August 5, 1886, extended by act of August 11, 1888, and as reduced in 1894, is to obtain a channel 3,000 feet long, 100 feet wide, and 12 feet deep at mean low water, and an anchorage basin of the same depth 40 acres in area, and construct two breakwaters at the entrance, at an estimated cost, as revised in 1894, of $145,000.

To June 30, 1908, the amount expended on the existing project is—for improvement, $133,227.33; for maintenance, $3,121.74; total, $136,349.07, with which the project has been completed; but it may be necessary to do some work on the breakwaters from time to time.

The maximum draft over the shoalest part of the improved channel and basin is 11 feet at mean low water. The mean range of tides is 8 feet.

The commerce benefited is inconsiderable, and the improvement is designed to afford a harbor of refuge for yachts and coastwise vessels.

The original project is published in the Annual Report of the Chief of Engineers for 1882, page 507; the modifications, with map of the harbor, in the report for 1887, page 470.

July 1, 1907, balance unexpended	$8,650.93
July 1, 1908, balance unexpended	8,650.93

(See Appendix A 15.)

16. Removing sunken vessels or craft obstructing or endangering navigation.—The wreck of the schooner *Island Queen*, sunk in the westerly part of Seal Harbor, Maine, in about 15 feet of water at mean low tide, was entirely removed June 26, 1908.

(See Appendix A 16.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of Tenants Harbor, Maine, with a view to obtaining 8 feet of water.—Report dated October 14, 1907, is printed in House Document No. 351, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

2. Preliminary examination with plan and estimate of cost of improvement of Matinicus Harbor, Maine, with a view to a harbor of refuge.—Reports dated October 10 and November 27, 1907, and January 2, 1908, respectively, are printed in House Document No. 653, Sixtieth Congress, first session. A plan of improvement at an estimated cost of $13,000 is presented.

3. Preliminary examination and survey of passage between Peaks Island and Great Diamond Island, between the main channel of Portland Harbor and Husseys Sound, Maine.—Reports dated September 6, 1907, and March 12, 1908, respectively, are printed in House Document No. 896, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States at the present time.

4. Preliminary examination and survey of East Boothbay Harbor, Maine, with a view to obtaining 8 feet of water.—Reports dated October 8, 1907, and February 20, 1908, are printed in House Document No. 944, Sixtieth Congress, first session. The improvement is not considered worthy of being undertaken by the United States.

5. Preliminary examination with plan and estimate of cost of improvement of Rockport Harbor, Maine, with a view to removing the beacon and ledge.—Reports dated October 21, 1907, and February 8, 1908, are printed in House Document No. 963, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $32,000 is presented.

6. Preliminary examination and survey of channel near South Harpswell, Me., with a view to removing ledge off Potts Point.—Reports dated September 7, 1907, and March 12, 1908, are printed in House Document No. 971, Sixtieth Congress, first session. The improvement is not considered worthy of being undertaken by the United States.

The local officer was also charged with the duty of making other preliminary examinations and surveys provided for by the river and harbor act of March 2, 1907, as follows, and reports thereon will be duly submitted when received:

1. Camden Harbor, Maine.

2. Penobscot Bay, from the southern extremity of Macks Point to the eastern extremity of Cape Jellison (Stockton Harbor), Maine.

3. Pepperells Cove, Maine.

4. Isles of Shoals, New Hampshire.

IMPROVEMENT OF RIVERS AND HARBORS IN THE BOSTON, MASSACHUSETTS, DISTRICT.

This district was in the charge of Lieut. Col. Edward Burr, Corps of Engineers, having under his immediate orders First Lieut. Henry C. Jewett, Corps of Engineers, to August 20, 1907, Lieut. Richard Park, Corps of Engineers, from September 15, 1907, to January 20, 1908, and First Lieut. Ulysses S. Grant, 3d, Corps of Engineers, since October 7, 1907. Division engineer, Col. John G. D. Knight, Corps of Engineers.

1. Newburyport Harbor, Massachusetts.—Prior to specific appropriations for Newburyport Harbor funds applicable to Merrimac River, of which it is the estuary, were devoted to removing a sand bar and constructing a breakwater at the river's mouth, 1828 to 1836, and to removing obstructing ledges, piers, and wrecks, 1870 to 1880. In its original condition the outlet of the Merrimac River, which, between Plum Island and Salisbury Point, was 1,000 feet wide and 30 feet deep at mean low water, was obstructed by a sand bar, nearly a mile outside, through which, in 1880, a narrow channel about 7 feet deep at mean low water was maintained by the current of the river.

The original project, adopted by the act of June 14, 1880, which is the existing project, is to create at the outer bar a permanent channel 1,000 feet wide and at least 17 feet deep at mean low water, by constructing two converging jetties, projecting, one from the north shore 2,910 feet, the other from the south shore 1,500 feet, their outer ends 1,000 feet apart, which, with the protection of the beach in their vicinity, was estimated in 1881 to cost $365,000. The direction of jetties and shore protection was modified in 1883, and in 1882 the partial closing of Plum Island Basin with a timber dike about 800 feet long and 5½ feet above mean low water was added to the project, increasing the cost (as estimated in 1884) to $375,000. In 1884 a modification of the project provided for extending both jetties 610 feet parallel to the axis of the channel and in 1886 for increasing that extension to 1,000 feet, increasing the cost of the work, as estimated in 1897, to $599,547.49.

To June 30, 1908, the amount expended on this project was $383,218.79, of which $7,821.79 was for maintenance. In addition, $500 was expended in 1901 for removal of North rock under authority of act of March 3, 1899. The expenditure for maintenance in the fiscal year 1908 was applied to retopping about 400 feet of the north jetty.

With the expenditure for improvement, the north jetty has been completed for a total length of 2,905 feet and the south jetty completed except for a distance of 30 feet at its outer end; the Plum Island Basin has been closed with a timber dike 817 feet long, 5½ feet high above mean low water, except near the middle, where a weir 150 feet long and 2 feet above mean low water was left temporarily, and two sand catchers, respectively 480 and 572 feet in length, have been built in rear of the south jetty. Both jetties are 15 feet wide on top, which is in a plane 12 feet above mean low water, and have slopes of 1 on 2 on the seaward face and 1 on 1 on the shoreward face. The project is about 80 per cent completed.

June 30, 1908, the maximum draft that can be carried over the bar at mean low water is 12.5 feet. The mean range of tides is 7.7 feet.

The commerce of the harbor, chiefly coal, amounted in 1906 to 169,975 tons, and in 1907 to 209,896 tons. Of the latter amount 98,442 tons were reshipped to points on the Merrimac and Powow rivers.

It is reported that the improvement made has reduced freight rates 25 cents per ton, and that if the projected depth of 17 feet at mean low water be obtained over the outer bar it would still further reduce the freight rates 15 to 25 cents per ton.

The amount estimated as a profitable expenditure in the fiscal year ending June 30, 1910, will be applied to the further extension of the north jetty.

The original project, as reported by a Board of Engineers, with map of the harbor, is published in Annual Report of the Chief of Engineers for 1881, page 502; the modifications in jetties and shore protection, in reports for 1883, page 437, and 1884, page 494; the parallel extension of the jetties, with map and additional estimate, in report for 1897, page 825, and a survey of the bar and entrance, in report for 1905, page 802.

A survey and map of the bar and entrance, with estimate for removing obstructions in the mouth of the river, are published in House Document No. 339, Fifty-ninth Congress, second session.

July 1, 1907, balance unexpended		$29,866.85
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$12,577.93	
For maintenance of improvement	2,507.21	
		15,085.14
July 1, 1908, balance unexpended		14,781.21
July 1, 1908, outstanding liabilities		3,563.88
July 1, 1908, balance available		11,217.33
July 1, 1908, amount covered by uncompleted contracts		9,327.50
Amount (estimated) required for completion of existing project		209,369.28
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908		30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(See Appendix B 1.)

2. *Merrimac River, Massachusetts.*—In its original condition the Merrimac River had a practicable channel 7 feet deep at mean low water from its mouth 9 miles to South Amesbury, but besides being narrow and crooked the channel was obstructed by ledges, bowlders, and shoals.

The original projects appear to have been—

(1) For improving the bar at the mouth of the river, by erection of piers or other works, adopted by act of May 23, 1828; subsequently improved under separate project for "Improving harbor at Newburyport, Mass."

(2) For the improvement of the river above the mouth, by the removal of the remains of a dam at the upper falls and of a rock at the lower falls, of Gangway rock in Newburyport Harbor, and a wreck near the mouth of the river.

Upon the original and modified projects, prior to operations under the existing project, there were expended: Upon the project of 1828, $67,466.72, and upon the project of 1870, as largely extended by the acts of June 23, 1874, and June 3, 1896, $187,000; total, $254,466.72.

The existing project, adopted by the act of March 3, 1899, is to obtain a channel 7 feet deep at mean low water, 150 feet wide, from Newburyport 14½ miles to Haverhill, at an estimated cost of $171,442.70.

The amount expended on the existing project to June 30, 1908, is $116,857.52, of which $1,432.75 was applied to maintenance of im-

provement, and 10 cents derived from sales. With this expenditure the channel has been completed to the full projected depth and width.

The commerce of the river is chiefly in coal distributed to the cities and towns along its banks, and amounted in 1906 to 73,827 tons, and in 1907 to 98,442 tons. The improvement of the channel is reported to enable the delivery of coal by water at rates 35 to 50 cents per ton less than by rail.

The head of navigation is at the hat factory, one-half mile above the railroad bridge at Haverhill, to which point the stream is navigable in fact, 17½ miles above its mouth in Newburyport Harbor.

June 30, 1908, the maximum draft that can be carried at mean low water over the shoalest part of the improved channel is 7 feet, except just below Rocks Bridge, where it is reduced by small bowlders to about 5 feet.

The mean range of tides is, at the mouth of the river, 7.7 feet, and at Haverhill Bridge 4.6 feet, at low-water stage of the river.

The project of 1870–1874 is published in the Annual Report of the Chief of Engineers for 1869, page 421; as extended in 1874, in report for 1876, page 165; as extended in 1896, in report for 1896, page 616; and the existing project adopted in 1899, in report for 1897, page 865.

The report of a survey, with estimate of cost, to deepen the channel to 9 feet at mean low water, is published in Annual Report for 1904, pages 872–878.

An examination for a channel 12 feet deep to Haverhill (unfavorably reported), and a survey and estimate for removing obstructions at the mouth of the river (favorably reported) made in 1906, are published in House Document No. 339, Fifty-ninth Congress, second session.

The project having been completed, it is proposed to apply the appropriation recommended to the maintenance of the improved channel.

July 1, 1907, balance unexpended	$13,812.48
June 30, 1908, amount expended during fiscal year for works of improvement	10,669.90
July 1, 1908, balance unexpended	3,142.58
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	20,000.00

(See Appendix B 2.)

3. Essex River, Massachusetts.—In its original condition Essex River had a channel not less than 6 feet deep at mean low water from its mouth in Ipswich Bay for a distance of about 2½ miles; but thence for 2½ miles to the head of navigation in fact at the railroad bridge at Essex, the channel was narrow, crooked, and shallow, having a greatest continuous depth of 1.7 feet, navigation being further impeded by bowlders obstructing the channel.

The original project, adopted July 13, 1892, which is also the existing project, is to obtain a channel 4 feet deep at mean low water and 60 feet wide to the head of navigation, at an estimated cost of $25,000; modified, March 23, 1899, by limiting the improvement to

the channel below the bridge at Essex, which had been rebuilt without a draw.

To June 30, 1908, the amount expended was $22,150, of which $390.79, expended in the fiscal year 1907, was for surveying the improved channel to ascertain the locality and extent of dredging necessary in maintenance. Although the completion of the channel up to the highway bridge at Essex was reported February 2, 1901, complaint was made in 1905 of an obstruction in mid-channel, and in June, 1905, a group of several bowlders, about 1,300 feet below the head of navigation and within the scope of the approved project, was removed at an expense of $300.

By the act of March 2, 1907, $5,000 was appropriated for the restoration of the channel in Essex River, with proviso:

> That no part of this sum shall be expended unless a further amount of five thousand dollars shall be provided by the State of Massachusetts or other agency, and made subject to the order of the Secretary of War in such manner as he may direct, to be expended upon said project under his direction.

By an act approved June 8, 1908, the legislature of Massachusetts appropriated $5,000, to be paid to the Secretary of War and to be expended in accordance with the proviso above quoted.

The maximum draft that can be carried, June 30, 1908, over the shoalest part of the locality under improvement is reported to be about 2 feet. The mean range of tides is 8.8 feet.

No freight is carried on the river, but the improvement is for the purpose of permitting the exit of about 30 fishing schooners which are built annually on the river, each of about 125 tons register, at an average cost of $12,000.

The project, with map and report of survey, is published in the Annual Report of the Chief of Engineers for 1891, pages 676–678.

The report of a preliminary examination of the river, made in 1905, is printed in House Document No. 68, Fifty-ninth Congress, first session.

July 1, 1907, balance unexpended	$7,850.00
July 1, 1908, balance unexpended	7,850.00

(See Appendix B 3.)

4. Harbor of refuge, Sandy Bay, Cape Ann, Massachusetts.—In its original condition this bay, whose southerly shore extends about 2 miles westerly from the point of Straitsmouth Island, and thence about 2 miles northerly to Andrews Point, had a good holding ground of sand mixed with mud, and a depth of 7½ to 15 fathoms at mean low water, but was fully exposed to easterly, northeasterly, and northerly gales. The original project, adopted by the act of July 5, 1884, was to build a breakwater consisting of a mound of rubblestone to the grade of 22 feet below mean low water, 40 feet wide on top, to be surmounted by a masonry wall, and to extend from Averys ledge a little west of north 3,600 feet to Abners ledge, thence 5,400 feet northwesterly in the direction of Andrews Point, covering an anchorage of about 1,377 acres.

This project, with the cross section of the breakwater as modified by a Board of Engineers February 13, 1900, is the existing project, the breakwater to consist of a mound of rubblestone built to the grade of 12 feet below mean low water, where it will have a width of 117 feet, its harbor slope to be 1 on 1, its seaward slope 1 on 1 up to 25

feet below mean low water, and 1 on 2 thence to the top, 12 feet below mean low water; the rubble mound to be surmounted with a core of rubblestone, to be faced with selected stone to be laid horizontally on the sea face, to weigh not less than 8 tons each and to be laid with a batter of 1 on 2, and on the harbor face to weigh not less than 3 tons each and be laid with a batter of 1 on 1; to be surmounted at grade 17 above mean low water with a single course of capstones, whose upper surface shall be 22 feet above mean low water; at an estimated cost (as revised in 1900) of $6,904,952.25.

The river and harbor act of March 2, 1907, authorized a continuing contract for this work to the extent of $100,000 in excess of the appropriations then made. Of this amount $75,000 remains to be appropriated.

The amount expended under the existing project to June 30, 1908, not including outstanding liabilities, is $1,461,172.56, all for improvement. From sale of property $1 was derived. With this expenditure 1,969,553 tons of rubblestone has been placed in the substructure of the breakwater, and its condition is approximately as follows:

In the southern arm for a length of 3,530 feet the mound of rubblestone has been completed up to the grade of 12 feet below mean low water, with the full width of 117 feet prescribed in the project; the rubble core of the superstructure has been built to the height of mean low water, 2,990 feet, and to the height of 5 feet above mean low water for 540 feet farther.

In the western arm for a length of 2,300 feet from the angle the mound of rubblestone has been likewise completed to the full height (12 feet below mean low water) and full width (117 feet) projected, except for a small bench on the inner slope 13 feet deep and 17 feet wide, and stone has been deposited for a farther distance of 75 feet without regular form; a rubble core of the superstructure has been built to the height of mean low water for 1,900 feet and to the height of mean high water for 400 feet.

Of the quantity of rubblestone required in the substructure, 41 per cent has been deposited, which is approximately 31 per cent of the quantity required for both substructure and superstructure.

The depth of water is ample for the largest vessels; the mean range of tides is 8.6 feet.

The appropriation recommended will be applied to extending the superstructure of the breakwater; $75,000 of the amount recommended will be required for payments under a continuing contract now in force.

The improvement is chiefly of value in providing refuge for coastwise vessels, especially towed barges, which are frequently and suddenly in urgent need of shelter in fog and snowstorms.

For description of Sandy Bay and original project, see Annual Report of the Chief of Engineers for 1884, pages 565–577. For cross section, details of construction, and increase in cost, see report of Board of Engineers, Annual Report for 1900, page 1186.

July 1, 1907, balance unexpended	$262,686.41
Amount appropriated by sundry civil act approved May 27, 1908	25,000.00
	287,686.41
June 30, 1908, amount expended during fiscal year for works of improvement	73,857.97
July 1, 1908, balance unexpended	213,828.44
July 1, 1908, outstanding liabilities	26,782.76
July 1, 1908, balance available	187,045.68
July 1, 1908, amount covered by uncompleted contracts	230,029.20
Amount (estimated) required for completion of existing project	5,229,952.25
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 575,000.00

(See Appendix B 4.)

5. Harbor at Gloucester, Mass.—In its original condition this harbor, which had a depth sufficient for the largest ships, contained several very dangerous submerged rocks and was entirely without protection against the sea and against heavy swells from the south.

The original project, adopted by the act of June 10, 1872, appears to have been for removal of five rocks, at an estimated cost of $10,606.20.

Under the original and modified projects the rocks were removed. Harbor Cove was dredged to the depth of 10 feet at mean low water, and the water front for a distance of 3,900 feet northeast from Fort Point was dredged to a depth of 15 feet at mean low water from the 15-foot contour to the wharf front, upon which there was expended prior to operations under the existing project approximately $86,000.

The existing project, adopted by the act of August 18, 1894, as curtailed by the act of June 13, 1902, is to build under continuing contract a breakwater from the shore about 2,250 feet to a point at or near Cat ledge, and upon completion of the breakwater to apply any balance remaining "toward the work of removing Round rock," at an estimated cost of $416,083.43.

The breakwater consists of a mound of rubblestone 31 feet wide at the top at mean low water, surmounted by a superstructure extending 17 feet above the grade of mean low water, formed by two dry walls of heavy split stone, inclosing a core of rubblestone, capped by heavy stones, forming a top course 10 feet in width, the slopes of the rubble structure being on the harbor side 1 on 1.3, on the seaward side 1 on 3 to grade 12 below mean low water, and 1 on 1.5 thence to the bottom.

The amount expended under the existing project to June 30, 1908, not including outstanding liabilities, is $410,239.16, all for improvement, with which 231,756 tons of stone has been put in place, completing, in 1905, the breakwater of the projected dimensions, including an expansion at its outer end for a site for a light-house.

The maximum draft that can be carried June 30, 1908, at mean low water over the shoalest part of the locality under improvement is 10

[a] Of this amount, $75,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907.

feet in Harbor Cove, 15 feet along the wharf front, and 30 feet in the anchorage under the breakwater.

The mean range of tides is 8.9 feet.

The commerce in 1904 amounted to 263,526 tons, in 1906 to 275,888 tons, and in 1907 to 233,516 tons, of which latter 65,000 tons was coal and 141,000 tons fish and salt. About 80,000 passengers were carried to and from this port by steamer.

It is proposed to apply the available balance toward the removal of Round rock. It is known that the removal of this rock will require funds in excess of the available balance, but the exact amount can not be determined until the completion of a detailed examination yet to be made.

A description of the original project is published in the Annual Report of the Chief of Engineers for 1871, page 870, and its modifications, with map, in the report for 1887, page 500.

The adoption and the commencement of work under the existing project are reported upon in the Annual Report of the Chief of Engineers for 1895, page 610.

July 1, 1907, balance unexpended	$5,843.84
July 1, 1908, balance unexpended	5,843.84

(See Appendix B 5.)

6. Harbor at Manchester, Mass.—In its original condition Manchester Harbor had a good channel 100 feet wide and not less than 6½ feet deep at mean low water, extending from the bay 3,200 feet to Proctors Point. At that distance the channel shoaled rapidly to a depth of 1½ feet at the Narrows, 1,400 feet from Proctors Point, and for the remaining distance, 2,600 feet, to the town wharves there was no practicable channel at low water.

The original project, adopted by the act of August 11, 1888, was to dredge a channel 60 feet wide and 4 feet deep at mean low water from Proctors Point, a distance of 4,000 feet, to the town wharves, at an estimated cost of $14,300.

The amount expended under the original project and prior to operations under the existing project was $14,300, obtaining a channel of the length, depth, and width prescribed in the project, expanded opposite the town wharves to the width of 80 feet; but the dredged channel deteriorated rapidly and thereafter there was some shoaling at the entrance.

The existing project, adopted by the river and harbor act of March 3, 1899, is to dredge the natural channel to the depth of 6 feet at mean low water from that depth in the bay, a distance of 7,200 feet, to the town wharves, 100 feet wide at the entrance and at the sharpest bends and at least 75 feet wide throughout, with two turning basins, one 200 feet by 300 feet in area, just below the drawbridge of the Boston and Maine Railroad, and the other 125 feet by 250 feet at the town wharves, for which the estimated cost is $25,000.

Under this project to the close of the fiscal year ending June 30, 1908, the amount expended is $9,685.57, all for improvement, with which a channel was obtained in 1903 of the full projected width and depth from the entrance to a point 220 feet below the southwest corner of Read's wharf, except that two small ledges, projecting about 20 feet, obstruct the eastern side of the channel about west of Proctors Point. The project was 31 per cent completed.

In a report dated July 20, 1903 (Annual Report for 1904, p. 841), the Board of Engineers for Rivers and Harbors recommended, with the concurrence of the Chief of Engineers, that the United States complete the 6-foot channel, to secure some return from the sums already expended thereon, and that when completed appropriations for this work cease, leaving it to those directly interested to provide for the maintenance of the improvement, involving an annual expenditure of a considerable amount. No appropriation has since been made by Congress, and no steps had been taken looking to the completion of the improvement until in 1907 dredging was resumed by the State and municipal authorities.

The State of Massachusetts has since completed the dredging of a channel from deep water to the railroad bridge, coinciding in location, width, and depth with the proposed Government channel. The remaining section of the proposed Government channel has been dredged by the town of Manchester, with the width of 75 feet increased near the town wharves to 125 feet, and the depth of 4 feet at mean low water.

The entire project for this harbor having been completed with the dimensions adopted by the local authorities most directly interested, and substantially in accordance with the recommendation of the Board of Engineers for Rivers and Harbors, the local officer has reported that the interests of navigation do not require the expenditure by the United States of further sums upon the project, and the Chief of Engineers, January 28, 1908, approved his recommendation that this project be discontinued by the United States forthwith.

It is reported that the maximum draft that can be carried over the shoalest part of the locality under improvement is 6 feet below the railroad bridge and 4 feet above that bridge, both depths at mean low water. The mean range of tides is 9 feet.

The commerce of the harbor benefited by the improvement consists chiefly of coal and building materials for local consumption, of which about 12,000 tons was reported received in 1900 and 6,388 tons in 1907.

The original project, with map of survey, is in the Annual Report of the Chief of Engineers for 1888, page 466.

The project of 1899, with map of survey, is published in the Annual Report of the Chief of Engineers for 1897, page 869.

July 1, 1907, balance unexpended	$314.43
July 1, 1908, balance unexpended	314.43

(See Appendix B 6.)

7. *Harbor at Beverly, Mass.*—In its original condition this harbor had a practicable channel 18 feet deep at mean low water from Monument bar beacon about 1 mile to its head, about 600 feet below the highway bridge, sufficient for the commerce of the harbor and of its three tributary streams, called, respectively, North River, Essex Branch, and Beverly Creek; but the channel, which is circuitous in its passage through the shoals at the entrance, was found, in 1900, to be "of insufficient width for safe navigation by heavy vessels."

The original project, adopted by the act of June 13, 1902, was to widen the channel from Monument bar beacon to a point about 200 feet east of Rams Horn beacon to a width of 200 feet, with a depth of 18 feet at mean low water, at an estimated cost of $10,000. Upon the

original project, prior to operations under the existing project, $8,272.10 was expended, with which the channel was enlarged to the dimensions authorized, except at three points, where the width was restricted by ledges to 106 feet.

The existing project, adopted by the act of March 2, 1907, is to obtain, by dredging and rock excavation, a channel 18 feet deep at mean low water, not less than 250 feet wide at the bend for a distance of about 3,200 feet from Bar beacon to Lobster rocks beacon, including the removal of the middle ground, and not less than 200 feet wide from Lobster rocks beacon to the lower end of the draw pier at the highway bridge, at an estimated cost of $40,000. In addition to $1,727.90 available, $38,500 was appropriated. By way of refundment, $122.24 was received as damages from the surety of a failing contractor under the previous project.

To the close of the fiscal year ending June 30, 1908, $18,917.59 has been expended on this project, all for improvement, with which all the dredging necessary to complete the project has been done. But the channel has a least width of only about 165 feet near Bar beacon, and at this and three other localities ledges remain to be removed, for which work a survey and plan have been completed.

The maximum draft that can be carried on June 30, 1908, at mean low water over the shoalest part of the locality under improvement is 18 feet. The mean range of tides is 9 feet.

The commerce of Beverly Harbor consists chiefly of coal and building materials, amounting in 1906 to 138,862 tons, and in 1907 to 179,578 tons, of which 119,000 was coal.

It is expected by those locally interested in shipping that the completion of the project will effect a substantial reduction in freight rates, which to this time have not been appreciably affected by the improvement in progress.

The report of a survey of this harbor is published in the Annual Report of the Chief of Engineers for 1890, page 524. The project of 1902, with report of survey, is in the Annual Report for 1901, page 1065.

The existing project, with report of survey and map, is published in House Document No. 916, Fifty-ninth Congress, first session.

July 1, 1907, balance unexpended	$40,319.34
June 30, 1908, amount expended during fiscal year for works of improvement	18,886.79
July 1, 1908, balance unexpended	21,432.55
July 1, 1908, outstanding liabilities	18.33
July 1, 1908, balance available	21,414.22

(See Appendix B 7.)

8. Harbor at Lynn, Mass.—An area of shoals extends from the wharves at Lynn 2½ miles southerly to the sea. It is protected from the sea by the peninsula of Lynn Beach and Nahant.

In its original condition three narrow and crooked channels, in which the depth was but 6 feet at mean low water, extended from the wharves to the sea.

The original project, defined in the report of a Board of Engineers dated April 10, 1884, and as modified in 1888, was to dredge a channel 200 feet wide and 10 feet deep at mean low water from the sea (at

White rocks), a distance of 3,300 feet to a deep basin opposite Little Nahant, and from the basin nearly opposite Sand Point, a distance of 6,900 feet to a point 400 feet inside the harbor line, and an anchorage basin 500 feet by 300 feet and 10 feet deep at mean low water; the upper part of the channel to be maintained by occasional dredging, the lower part by a training wall joining the land at Little Nahant, at an estimated cost of $182,000.

The amount expended on this project was $122,063.56, all for improvement, with which the entire channel and the anchorage basin as prescribed in the project were completed.

The existing project, adopted by the river and harbor act of June 13, 1902, is to dredge the channel 200 feet wide from the sea to the anchorage basin and the anchorage basin itself to the depth of 15 feet at mean low water, at an estimated cost of $162,937. Under this project to the close of the fiscal year ending June 30, 1908, $157,441.72 has been expended, all for improvement, with which the projected channel has been completed.

The maximum draft that can be carried June 30, 1908, over the shoalest part of the locality under improvement is 15 feet at mean low water. The mean range of tides is 9.3 feet.

The commerce of the harbor benefited by the improvement consists chiefly of coal, lumber, and building materials, of which about 366,327 tons was carried during the year. The deepening of the channel to 15 feet enables the smaller or medium size barges to carry full cargoes of coal to the wharves at all stages of the tide and barges of the greatest draft during the higher stages.

It is reported by local commercial interests that the cost of transportation was reduced 25 cents a ton by deepening the channel to 10 feet, and further diminished by increasing the depth to 15 feet, but that the full benefit of the improvement will not be realized until the channel and turning basin have been widened as recommended in House Document No. 948, Sixtieth Congress, first session, saving pilotage and towage charges.

The original project approved by the Secretary of War April 21, 1884, is in the Annual Report of the Chief of Engineers for 1884, page 524, and the map of the harbor at page 532.

The existing project was published in the Annual Report of the Chief of Engineers for 1901, page 1093.

Reference to reports on examination and survey made in pursuance of act of March 2, 1907, will be found on page 77 of this report.

July 1, 1907, balance unexpended	$36,907.88
June 30, 1908, amount expended during fiscal year, for works of improvement	24,976.16
July 1, 1908, balance unexpended	11,931.72
July 1, 1908, outstanding liabilities	4,533.61
July 1, 1908, balance available	7,398.11

(See Appendix B 8.)

9. Mystic and Malden rivers, and Mystic River below the mouth of Island End River, Massachusetts.—(a) Mystic River.—In its original condition the Mystic had a practicable channel 6 feet deep at mean low water extending to Dennings Landing, 3.9 miles above its

mouth in Boston Harbor, and 4 feet deep at mean low water about 2,000 feet farther.

The original project for improvement, adopted by the act of July 13, 1892, which is also the present project, is to make the channel 100 feet wide and 6 feet deep at mean low water from the Boston and Maine Railroad (Western Division) bridge up about 1 mile to the first turn above Denning's wharf; and thence 2 miles to the head of navigation at Medford, 4 feet deep at mean low water, gradually narrowing from 100 feet to 50 feet at the upper end, at an estimated cost of $25,000.

The amount expended to close of the fiscal year, June 30, 1908, is $28,794.88, with which the projected channel was completed in November, 1906.

The maximum draft that can be carried, June 30, 1908, at mean low water is 6 feet up to the first turn above Denning's wharf, and thence to the head of navigation 4 feet. The mean range of tides is 9.8 feet.

The head of navigation is the upper limit of that part of the channel under improvement, at the stone bridge at Medford, to which point, 6 miles above its confluence with the Charles River in Boston Harbor, the stream is navigable in fact.

The commerce benefited by this improvement, chiefly coal, amounted in 1906 to 17,500 tons and in 1907 to 23,791 tons. It is reported that as the smallest barges go out of use the improvement will permit barges of the lightest draft remaining in service to deliver coal at Medford without the expense of lightering, which would be about 50 cents per ton.

A report, with map of the survey of Mystic River and description of the project, is in the Annual Report of the Chief of Engineers for 1891, page 674.

Report of an examination of the river, with a view to its improvement to the upper limits of the city of Somerville, ordered by the act of March 3, 1905, is printed in House Document No. 144, Fifty-ninth Congress, first session.

The appropriation asked for will be applied to maintenance of the improvement.

July 1, 1907, balance unexpended	$10,200.00
Allotted to Malden River	2,000.00
July 1, 1908, balance unexpended	[a] 8,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	([b])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

[a] Includes $8,000 reserved in Treasury not yet formally allotted.
[b] See consolidated money statement on page 58.

(*b*) *Malden River.*—In its original condition the Malden had a practicable channel 4 feet deep at mean low water, extending only 2,000 feet above its confluence with the Mystic.

The original project, adopted by the act of August 2, 1882, was to make the channel 100 feet wide and 12 feet deep at mean high water to the Charles Street Bridge, about 1.8 miles above its confluence with the Mystic, at an estimated cost of $35,000.

The amount expended on the Malden River under the original project and prior to operations under the existing project was $10,000, in obtaining a channel with a least width of 50 feet and 70 feet at turns, with a depth of 12 feet at mean high water from the mouth to the Medford Street Bridge at Malden, a distance of 1¼ miles.

The existing project, adopted by the act of July 13, 1892, is to dredge a channel 12 feet deep at mean high water 100 feet wide to the Medford Street Bridge, 1.6 miles above its confluence with the Mystic, and 75 feet wide about 1,200 feet farther to the Charles Street Bridge, at an estimated cost of $37,000.

The amount expended under the existing project to June 30, 1908, is $40,789.11 (including $25,802.72 for maintenance), with which in 1897 a channel was completed 100 feet wide and 12 feet deep at mean high water up to the Medford Street Bridge. The local officer has reported the river above this bridge to be unworthy of improvement by the United States at this time. The expenditure for maintenance in the fiscal year 1908 was applied to redredging the channel to the full projected depth and width from the Medford Street Bridge for a distance of about 3,600 feet downstream, which work is in progress at the date of this report.

The maximum draft that can be carried at mean high water, June 30, 1908, through the improved channel is 12 feet. The mean range of tides is 9.8 feet.

The head of navigation is at the Medford Street Bridge at Malden, to which point the stream is navigable in fact, 1.6 miles above its confluence with the Mystic River.

The commerce amounted in 1906 to 90,815 tons, and in 1907 to 88,575 tons, chiefly coal. The improvement is reported to enable the smallest barges, or larger barges with partial cargoes, to deliver coal at Malden, saving the cost of lightering—50 cents per ton.

A report of the survey of Malden River and description of the original project is on page 532, Annual Report of the Chief of Engineers for 1881.

The modifications of the project are stated in the Annual Report of the Chief of Engineers for 1900, page 1191.

The existing project is described on page 672, Annual Report of the Chief of Engineers for 1891.

The appropriation asked for will be applied to maintenance of the improvement.

July 1, 1907, balance unexpended	$10,800.00
Allotted and transferred from Mystic River	2,000.00
	12,800.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,589.11
July 1, 1908, balance unexpended	11,210.89
July 1, 1908, outstanding liabilities	7,125.41
July 1, 1908, balance available	4,085.48
July 1, 1908, amount covered by uncompleted contracts	3,244.86
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*c*) *Mystic River below the mouth of Island End River.*—Island End River is 1¼ miles above the mouth of the Mystic, at the navy-yard in Charlestown, and 2,700 feet above the Chelsea drawbridge over the Mystic.

In its original condition the Mystic up to Island End River had a narrow channel 14.4 feet deep at mean low water, but so narrow above the drawbridge as to be barely practicable.

The original project, adopted by the act of March 3, 1899, which is also the existing project, is to dredge a channel 25 feet deep at mean low water and 300 feet wide, embracing 1.7 miles of the Mystic, extending from its mouth to a point 800 feet above Island End River, at a cost estimated in August, 1899, at $267,547.50 (reduced estimate).

To June 30, 1908, $116,189.89 (all for improvement, except $10,281.92 for maintenance) had been expended in obtaining a channel 25 feet deep at mean low water, with a minimum width of 150 feet off the East Boston wharves, 200 feet wide thence to Chelsea bridge, and 300 feet from Chelsea bridge to a point just above the confluence of the Island End River. The expenditure for maintenance during the fiscal year was applied to restoring the depth and width of the channel above Chelsea bridge.

With funds appropriated by the act of March 2, 1907, the dredging below Chelsea bridge will be completed in conjunction with the dredging in the same locality for the 35-foot channel of Boston Harbor.

The commerce of the river, which in 1901 amounted to 1,430,650 tons, had increased to 3,746,463 tons in 1907, a gain of 162 per cent in six years. About three-fourths of all the freight carried on the river is coal.

The maximum draft that can be carried June 30, 1908, over the shoalest part of the locality under improvement is at mean low water 25 feet. The mean range of tides is 9.6 feet.

[a] See consolidated money statement on page 58.

July 1, 1907, balance unexpended		$40,000.00
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$10,184.77	
For maintenance of improvement	10,000.00	
		20,184.77
July 1, 1908, balance unexpended		19,815.23
July 1, 1908, amount covered by uncompleted contracts		17,847.36
Amount (estimated) required for completion of existing project		141,824.30

CONSOLIDATED.

July 1, 1907, balance unexpended		$61,000.00
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$10,184.77	
For maintenance of improvement	11,589.11	
		21,773.88
July 1, 1908, balance unexpended		39,226.12
July 1, 1908, outstanding liabilities		7,125.41
July 1, 1908, balance available		32,100.71
July 1, 1908, amount covered by uncompleted contracts		21,092.22
Amount (estimated) required for completion of existing project		141,824.30
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[a] 20,000.00

(See Appendix B 9.)

10. Harbor at Boston, Mass.—In its original condition the headlands and islands were without protection against the sea, which was extensively eroding them. Dangerous rocks obstructed the approach and entrance from Nantasket Roads to the lower main ship channel through the Narrows. That channel was 23 feet deep at mean low water with a least width of 150 feet. The upper main ship channel from President Roads to Boston had a least depth of 18 feet at mean low water with a least width of 100 feet. The channel from President Roads to Broad Sound in the ocean had a least depth of 29 feet at mean low water with a least width of 200 feet.

The original project, adopted by the act of March 2, 1825, was "for the preservation of the islands in Boston Harbor, necessary to the security of that place," and until 1866 all expenditures, amounting to $546,526.10, appear to have been applied to that purpose in the building and repair of sea walls. The amount expended upon them since 1866 can not be accurately stated.

The project for the improvement of the harbor adopted by the act of March 2, 1867, was (as modified) to make the main ship channel from Nantasket Roads to Boston 23 feet deep at mean low water, 600 feet wide through the Narrows to President Roads, and 1,000 feet wide from President Roads to Boston.

To this project of improvement were added, from time to time, minor channels within or tributary to the harbor, since completed with allotments from the appropriation for Boston Harbor, known

[a] For Mystic and Malden rivers only, no estimate being submitted for Mystic River below mouth of Island End River.

as Nantasket Beach channel, Nix Mate channel, Jeffries Point channel, Chelsea Creek, and Fort Point channel. The Charles River project is now in progress.

Under the original project for sea walls and supplemental projects for the channels above named, there has been expended for improvement and maintenance to June 30, 1908, $2,612,747.31, exclusive of all expenditures upon the five existing projects (three for the main channels and two for tributary channels), with which expenditure 3.75 miles of sea walls were built, protecting the most exposed headlands and islands, the subordinate channels described in the preceding paragraph (except Charles River) were completed, and a channel obtained 23 feet deep at mean low water from Nantasket Roads to Boston, with a least width of 625 feet in the Narrows and 850 feet between President Roads and the city. From sales of property $122.25 has been derived.

The amount requested for general improvement will be applied to necessary repairs to sea walls and maintenance of improvements heretofore made in the tributary channels of the harbor.

The projects for improvement of the main channels under which operations were carried on during the fiscal year are—

1. Adopted by the river and harbor act of July 13, 1892. To widen the main ship channel, from Nantasket Roads to Boston, to 1,000 feet, and to deepen it to 27 feet at mean low water, at an estimated cost of $1,250,000, subsequently increased to $1,488,751. Project completed.

2. Adopted by the river and harbor act of March 3, 1899. To widen the Broad Sound channel to 1,200 feet, and to deepen it to 30 feet at mean low water, at an estimated cost of $455,000. Project completed.

3. Adopted by the river and harbor act of June 13, 1902. To provide channels 35 feet deep at mean low water, 1,200 feet wide from the navy-yard at Charlestown and the Chelsea Bridge and Charles River Bridge to President Roads, and 1,500 feet wide from President Roads through Broad Sound to the ocean, at an estimated cost of $7,994,000 in round numbers. This estimate differs from any made in the project quoted in the act as the basis of the appropriation, owing to the different width of the channels adopted. (To avoid a large amount of rock excavation the 35-foot channel from President Roads to Broad Sound is in a different location from the 30-foot channel.)

Under the project of July 13, 1892, to June 30, 1908, not including outstanding liabilities, the amount expended was $1,472,606.29, of which $58,215.30 was for maintenance, and $10 derived from sales. With the total amount expended under this project the upper and lower main ship channels from Boston to President Roads and from President Roads to the sea have been dredged to the width of 1,000 feet and depth of 27 feet at mean low water. In the upper main ship channel the full width and depth are available. In the lower main ship channel the available width of the 27-foot channel is contracted by shoals to 650 feet. The maximum draft that can be carried at mean low water, June 30, 1908, over the shoalest part of the locality under improvement is 27 feet. A map of the project is in the Annual Report of the Chief of Engineers for 1894, page 554.

Under the project of March 3, 1899, to June 30, 1908, the amount expended was $385,200, all for improvement, with which a channel

July 1, 1907, balance unexpended		$40,000.00
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$10,184.77	
For maintenance of improvement	10,000.00	
		20,184.77
July 1, 1908, balance unexpended		19,815.23
July 1, 1908, amount covered by uncompleted contracts		17,847.36
Amount (estimated) required for completion of existing project		141,824.30

CONSOLIDATED.

July 1, 1907, balance unexpended		$61,000.00
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$10,184.77	
For maintenance of improvement	11,589.11	
		21,773.88
July 1, 1908, balance unexpended		39,226.12
July 1, 1908, outstanding liabilities		7,125.41
July 1, 1908, balance available		32,100.71
July 1, 1908, amount covered by uncompleted contracts		21,092.22
Amount (estimated) required for completion of existing project		141,824.30
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908		[a] 20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix B 9.)

10. Harbor at Boston, Mass.—In its original condition the headlands and islands were without protection against the sea, which was extensively eroding them. Dangerous rocks obstructed the approach and entrance from Nantasket Roads to the lower main ship channel through the Narrows. That channel was 23 feet deep at mean low water with a least width of 150 feet. The upper main ship channel from President Roads to Boston had a least depth of 18 feet at mean low water with a least width of 100 feet. The channel from President Roads to Broad Sound in the ocean had a least depth of 29 feet at mean low water with a least width of 200 feet.

The original project, adopted by the act of March 2, 1825, was "for the preservation of the islands in Boston Harbor, necessary to the security of that place," and until 1866 all expenditures, amounting to $546,526.10, appear to have been applied to that purpose in the building and repair of sea walls. The amount expended upon them since 1866 can not be accurately stated.

The project for the improvement of the harbor adopted by the act of March 2, 1867, was (as modified) to make the main ship channel from Nantasket Roads to Boston 23 feet deep at mean low water, 600 feet wide through the Narrows to President Roads, and 1,000 feet wide from President Roads to Boston.

To this project of improvement were added, from time to time, minor channels within or tributary to the harbor, since completed with allotments from the appropriation for Boston Harbor, known

[a] For Mystic and Malden rivers only, no estimate being submitted for Mystic River below mouth of Island End River.

as Nantasket Beach channel, Nix Mate channel, Jeffries Point channel, Chelsea Creek, and Fort Point channel. The Charles River project is now in progress.

Under the original project for sea walls and supplemental projects for the channels above named, there has been expended for improvement and maintenance to June 30, 1908, $2,612,747.31, exclusive of all expenditures upon the five existing projects (three for the main channels and two for tributary channels), with which expenditure 3.75 miles of sea walls were built, protecting the most exposed headlands and islands, the subordinate channels described in the preceding paragraph (except Charles River) were completed, and a channel obtained 23 feet deep at mean low water from Nantasket Roads to Boston, with a least width of 625 feet in the Narrows and 850 feet between President Roads and the city. From sales of property $122.25 has been derived.

The amount requested for general improvement will be applied to necessary repairs to sea walls and maintenance of improvements heretofore made in the tributary channels of the harbor.

The projects for improvement of the main channels under which operations were carried on during the fiscal year are—

1. Adopted by the river and harbor act of July 13, 1892. To widen the main ship channel, from Nantasket Roads to Boston, to 1,000 feet, and to deepen it to 27 feet at mean low water, at an estimated cost of $1,250,000, subsequently increased to $1,488,751. Project completed.

2. Adopted by the river and harbor act of March 3, 1899. To widen the Broad Sound channel to 1,200 feet, and to deepen it to 30 feet at mean low water, at an estimated cost of $455,000. Project completed.

3. Adopted by the river and harbor act of June 13, 1902. To provide channels 35 feet deep at mean low water, 1,200 feet wide from the navy-yard at Charlestown and the Chelsea Bridge and Charles River Bridge to President Roads, and 1,500 feet wide from President Roads through Broad Sound to the ocean, at an estimated cost of $7,994,000 in round numbers. This estimate differs from any made in the project quoted in the act as the basis of the appropriation, owing to the different width of the channels adopted. (To avoid a large amount of rock excavation the 35-foot channel from President Roads to Broad Sound is in a different location from the 30-foot channel.)

Under the project of July 13, 1892, to June 30, 1908, not including outstanding liabilities, the amount expended was $1,472,606.29, of which $58,215.30 was for maintenance, and $10 derived from sales. With the total amount expended under this project the upper and lower main ship channels from Boston to President Roads and from President Roads to the sea have been dredged to the width of 1,000 feet and depth of 27 feet at mean low water. In the upper main ship channel the full width and depth are available. In the lower main ship channel the available width of the 27-foot channel is contracted by shoals to 650 feet. The maximum draft that can be carried at mean low water, June 30, 1908, over the shoalest part of the locality under improvement is 27 feet. A map of the project is in the Annual Report of the Chief of Engineers for 1894, page 554.

Under the project of March 3, 1899, to June 30, 1908, the amount expended was $385,200, all for improvement, with which a channel

1,200 feet wide and 30 feet deep at mean low water was dredged from President Roads to Broad Sound, embracing the dredging of 965,383.9 cubic yards of sand, gravel, and clay and 198.864 cubic yards of bowlders and the removal of 156 cubic yards of ledge. The maximum draft that can be carried at mean low water, June 30, 1908, over the shoalest part of the locality under improvement is 30 feet. The project is published in Annual Report of the Chief of Engineers for 1898, page 886.

Under the project of June 13, 1902, continuing contracts to the amount of $3,600,000 were authorized by the act of that date, and pursuant thereto a channel of the full projected depth, but 540 feet wide, from the navy-yard, Charles River Bridge, and Chelsea Bridge to President Roads, and 675 feet wide from President Roads through Broad Sound to the ocean, was begun in 1903 and is now nearing completion. By the act of March 2, 1907, Congress authorized the completion of the 35-foot channel to the full projected widths, appropriating $500,000 for the purpose and authorizing contracts to the amount of $3,894,000 additional, which sum remains to be appropriated. Under this authorization a single contract for all the dredging required to complete the channel has been let and work was begun on October 28, 1907. Contracts for rock excavation will be let from time to time as ledge may be uncovered by the dredging.

To June 30, 1908, the amount expended, not including outstanding liabilities, was $2,717,284.87 ($55.89 was derived from sales), all for improvement, with which 8,121,346 cubic yards of mud, sand, gravel, and clay, and 18.642 cubic yards of bowlders have been dredged from the upper main ship channel; and 1,938,264 cubic yards of mud, sand, gravel, clay, hardpan, and cobblestones, and 82.818 cubic yards of bowlders have been dredged from Broad Sound channel. The total amount dredged is 10,059,711 cubic yards, or about 46 per cent in volume of all the dredging under the project. But as there will be a large amount of costly rock excavation, less than 46 per cent of the project has been accomplished. The dredging necessary to obtain the channels of partial width described in the preceding paragraph and begun in 1903, is about 93 per cent completed, and the removal of the ledge from this partial width is about 75 per cent completed under two contracts, one let in 1905, which is about 99 per cent completed, and another in 1907, which is about 50 per cent completed. No continuous channel with the depth of 35 feet at mean low water has yet been obtained.

The appropriation recommended will be applied to dredging and rock excavation under continuing contracts.

A map of the project is published in the Annual Report of the Chief of Engineers for 1903, page 768.

The mean range of tides is 9.5 feet at Boston light and 9.6 feet in the upper harbor.

The foreign exports and imports for the port of Boston during the calendar year ending December 31, 1906, amounted in value to $209,703,986, being an increase of $143,017,465 over the valuation in 1867, when the systematic improvement of the channels was begun.

As to the effect of the improvement on freight rates, the general manager of the principal foreign steamship lines entering this port states that about thirty years ago steamers were employed with a loaded draft of 20 feet to 24 feet; twenty-two or twenty-three years

ago, of 25 to 26 feet; fourteen years ago, 27 or 28 feet; ten years ago, 28 feet 9 inches; later, 31 feet, and recently one of 33 feet 10½ inches. He states, generally—

that freight rates, caused by the larger class of steamers being used, are about 50 per cent less than they were some fifteen or twenty years ago, when very much smaller steamers were engaged in the trade.

Tributary channels.—(*a*) *Charles River.*—In the original condition of the 9 miles of natural channel of this river, from its mouth to the dam at the head of navigation at Watertown, the depth at mean low water, from the mouth 4¾ miles to the Western Avenue Bridge, was not less than 7 feet, except in several places, covering about 1¼ miles, below Brookline Bridge, where the depth varied from 4½ to 7 feet. From Western Avenue Bridge 2½ miles to the Arsenal Street Bridge the depth was 4 feet. Thence 1¾ miles to the dam it varied between 0 and 9½ feet.

The original project, adopted by the act of June 14, 1880, which is also the existing project, is to widen and deepen the natural channel so that at mean low water it shall be from its mouth to Western Avenue Bridge 200 feet wide and not less than 7 feet deep; thence to Market Street Bridge 80 feet wide and 6 feet deep; thence to the dam 60 feet wide and 2 feet deep; at an estimated cost of $125,000.

The amount expended to June 30, 1908, is $57,500, all for improvement, with which the channel has been completed as prescribed in the project up to the Arsenal Street Bridge (now called also Western Avenue Bridge). The project has been 40 per cent completed.

The maximum draft that can be carried June 30, 1908, at mean low water over the shoalest part of the locality improved is 6 feet. The mean range of tides is 9.3 feet.

The head of navigation is at the dam at Watertown, the upper limit of that part of the channel under improvement, to which point, 9 miles above its confluence with Mystic River in Boston, the stream is navigable in fact.

The improvement made by the United States lies wholly above the West Boston (Cambridge) drawless bridge, completed in 1907, which precludes the passage of all masted vessels. The tidal basin is now being converted by the State of Massachusetts into a fresh-water lake with dam and lock; almost the entire river front has been acquired for park purposes; and on the section of the river under improvement all but three commercial wharves have been extinguished. The commerce benefited by the improvement consisted in 1906 of 113,341 tons and in 1907 of 83,335 tons, all coal, the improvement enabling the delivery at wharves on the river without breaking cargoes at Boston, saving the cost of one handling and the greater cost of transportation from Boston by rail.

The district officer is of opinion that so much of the existing project as provides for a channel from Brackett's wharf to Market Street Bridge, a distance of about 1,300 feet, and from Market Street Bridge to the dam at Watertown, is unworthy of prosecution by the General Government. This opinion is concurred in. The river and harbor act of September 19, 1890, appropriated $20,000 for continuing improvement of Charles River—

Provided, That no expenditure of said twenty thousand dollars shall be made until the draws in the Arsenal Street and Market Street bridges shall be made to conform to the projected channel without cost to the United States.

The Arsenal Street Bridge has been altered to conform to the projected channel, and as the Market Street Bridge is above the limits to which it is now believed that the channel should be extended, it is recommended that Congress authorize the expenditure of the $20,000 appropriated in 1890 in obtaining a channel of the projected width and depth to Brackett's wharf and in maintaining the Charles River improvement.

A full description of the project, together with map of the river showing the progress of the improvement to this date, is on page 512, Annual Report of the Chief of Engineers for 1884.

(*b*) *Fort Point channel.*—In its original condition the mid-channel depth was 12 feet at its mouth and 16 feet thence to the Federal Street Bridge, excepting at the draw in the Congress Street Bridge, where it was 14.5 feet at mean low water.

The original project, adopted by the act of August 5, 1886, which is also the existing project, is to dredge a channel 175 feet wide and 23 feet deep at mean low water from the entrance about 4,190 feet to near Federal Street Bridge, at an estimated cost of $100,000, reduced in 1887 to $78,750.

The total cost to the United States was $70,527 (including $9,219.10 for maintenance) with which the improvement was completed in November, 1907. In the execution of this work there were dredged in 1897, 94,211 cubic yards, and in 1907, 157,940 cubic yards; total, 252,151 cubic yards. The expenditure of $9,219.10 for maintenance in the fiscal year 1908 was due to deterioration of the dredging done in 1887.

The maximum draft that can be carried June 30, 1908, at mean low water over the shoalest part of the improved channel is 23 feet. The mean range of tides is 9.6 feet.

The head of navigation is the southern extremity of South Bay, at Massachusetts avenue, Boston, Mass., to which point, about 2 miles from the entrance to the channel in Boston Harbor, the channel is navigable in fact.

The commerce benefited by this improvement consists of coal, sugar, building materials, and miscellaneous merchandise, which amounted in the calendar year 1906 to 1,416,671 tons, and in 1907 to 1,443,686 tons.

For a description of the project see Annual Report of the Chief of Engineers for 1888, page 452.

PROJECT FOR GENERAL IMPROVEMENT.

July 1, 1907, balance unexpended	$89,858.80
June 30, 1908, amount expended during fiscal year for works of improvement	14,779.57
July 1, 1908, balance unexpended	75,079.23
Amount (estimated) required for completion of existing project	47,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	25,000.00

PROJECT OF 1892 FOR 27-FOOT CHANNEL.

July 1, 1907, balance unexpended	$55,605.16
June 30, 1908, amount expended during fiscal year for works of improvement	22,605.16
July 1, 1908, balance unexpended	33,000.00

PROJECT OF 1899 FOR 30-FOOT CHANNEL THROUGH BROAD SOUND.

July 1, 1907, balance unexpended	$69,800.00
July 1, 1908, balance unexpended	69,800.00

PROJECT OF 1902 FOR 35-FOOT CHANNEL.

July 1, 1907, balance unexpended	$2,059,711.11
June 30, 1908, amount expended during fiscal year for works of improvement	676,940.09
July 1, 1908, balance unexpended	1,382,771.02
July 1, 1908, outstanding liabilities	318,270.43
July 1, 1908, balance available	1,064,500.59
July 1, 1908, amount covered by uncompleted contracts	3,497,808.35
Amount (estimated) required for completion of existing project	3,894,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	1,400,000.00

(See Appendix B 10.)

11. Dorchester Bay and Neponset River, Massachusetts.—Dorchester Bay is at the mouth of Neponset River, in Boston Harbor. The present controlling depth at mean low water in the bay up to Commercial Point, at the mouth of the river, is 13 feet; thence up the river to the highway bridge at Neponset, 1½ miles above its mouth, it is 8 feet, and from said bridge up to Milton Mills, 4 miles above its mouth and at the head of navigation, it is 3½ feet.

The original project, which is also the existing project, adopted by the act of March 2, 1907, is to obtain by dredging a channel 175 feet wide and 18 feet deep at mean low water through Dorchester Bay and the mouth of the river to Commercial Point; and 100 feet wide and 15 feet deep at mean low water in Neponset River from Commercial Point to the Neponset highway bridge; estimated to cost $125,233.34.

The act of March 2, 1907, appropriated the full amount of the estimate, with the proviso:

> That no part of this sum shall be expended until the Secretary of War shall have received satisfactory assurance that the improvement of that portion of the Neponset River described in said House document [No. 83, 59th Cong., second session], which lies above the project herein adopted, shall be made and hereafter maintained by the State of Massachusetts or other agency without expense to the Government of the United States.

The improvement contemplated under this proviso is to secure a channel 6 feet deep from Neponset highway bridge to Milton Mills, 100 feet wide between the said bridge and the Granite bridge, 75 feet wide thence to Godfrey's wharf, and thence 50 feet wide for a farther distance of 250 feet.

The legislature of Massachusetts by the following resolves, approved by the governor June 24, 1907, and March 5, 1908, respectively, has given assurance satisfactory to the Secretary of War that the improvement of the river above Neponset bridge will be made and hereafter maintained by the State of Massachusetts:

That there be allowed and paid out of the treasury of the Commonwealth a sum not exceeding thirty-four thousand two hundred and seventy dollars and forty-four cents to be expended under the direction of the harbor and land commissioners in the improvement of that part of the Neponset River which lies above the Neponset highway bridge: *Provided, however*, That no part of said amount shall be so expended until the United States shall have completed the improvement of Dorchester Bay and the Neponset River to a point at the aforesaid Neponset highway bridge.

* * * * * * *

That the conditions set forth in the act of Congress known as the river and harbor act approved March second, nineteen hundred and seven, which requires that no part of the sum appropriated by Congress by said act shall be expended until the Secretary of War shall have received satisfactory assurance that the improvement of a certain part of the Neponset River above the improvement provided for by the said act of Congress shall hereafter be maintained by the Commonwealth of Massachusetts or other agency, without expense to the Government of the United States, are hereby accepted, and the said conditions shall be observed by the Commonwealth in accordance with the terms of the act of Congress aforesaid.

The amount expended on this project to June 30, 1908, is $40.48, in payment for printing specifications and other office expenses. Dredging is about to be commenced under a contract for the completion of the entire improvement authorized by Congress.

The maximum draft that can be carried at mean low water over the shoalest part of the channel to be improved is 13 feet to Commercial Point, and 8 feet to Neponset highway bridge. The mean range of tides is 9.6 feet.

During the calendar year 1906 the total commerce of the bay and river was 334,026 tons, and in 1907, 349,764 tons, of which 64,384 tons was carried to Milton above the limits of the improvement undertaken by the United States.

The purpose of the improvement is to permit the delivery at the localities concerned of freight, principally coal, at the lowest freight rates, by providing a depth of water necessary to accommodate ocean-going barges.

The head of navigation is at Milton Mills, to which point 4 miles above the mouth of the river the stream is navigable in fact.

The project for the improvement of the bay and river, with report and map of survey, is published in House Document No. 83, Fifty-ninth Congress, second session. The report of an examination of this river made in 1892 is printed in the Annual Report of the Chief of Engineers for 1893, page 800; and the report of an examination and survey in 1897, in the Annual Report for 1897, page 876.

July 1, 1907, balance unexpended	$125,233.00
June 30, 1908, amount expended during fiscal year for works of improvement	40.48
July 1, 1908, balance unexpended	125,192.52
July 1, 1908, amount covered by uncompleted contracts	77,350.00

(See Appendix B 11.)

12. Weymouth River, Massachusetts.—(*a*) *Weymouth Fore River.*—In its original condition the channel had a depth of 18 feet at mean

low water with a least width of 300 feet up to a point about 1 mile below Weymouth Fore River bridge, at Quincy Point, the 18-foot channel extending 3,400 feet above that point, but too tortuous for safe navigation of large vessels. In the remaining 1,800 feet to the bridge the channel, when surveyed, was 150 feet wide and 13 feet deep at mean low water, but, before the adoption of the project, had been increased without expense to the United States to the width of 200 feet and depth of 15 feet at mean low water. Above the bridge the channel was 12 feet deep at mean low water for a distance of 2,200 feet, 6 feet deep with a practicable width a distance of 4,000 feet farther, and 3 feet deep a distance of 7,000 feet farther; but the channel was too narrow to be practicable.

The original project, adopted by the act of September 19, 1890, was to obtain in Weymouth Fore River for a distance of 7,000 feet below the head of navigation a channel with the uniform depth of 6 feet at mean low water with the width of 100 feet to near Weymouth Landing, 80 feet thence to Braintree Bridge, and 50 feet thence 950 feet above that bridge, at an estimated cost of $40,000. The amount expended under that project was $42,750 (including $2,750 for maintenance), with which, except for four small ledges uncovered by dredging, there was dredged and maintained to 1906 a channel of the full projected dimensions, the future maintenance of which devolves upon the State of Massachusetts under acts of Congress and the legislature of Massachusetts, printed on pages 824 and 825 of the Annual Report of the Chief of Engineers for 1905.

The existing project, adopted by the act of March 3, 1905, embraces only that portion of the river extending from its mouth in Hingham Bay about 3½ miles up to Weymouth Fore River bridge at Quincy Point, and is to dredge a channel about 1 mile long, 300 feet wide, and 18 feet deep up to that bridge, at an estimated cost of $57,500.

The amount expended on this project is $53,034.20, all for improvement, with which the authorized channel has been completed.

The maximum draft that can be carried through the portion of the river embraced in this improvement is 18 feet at mean low water. The mean range of tides is 9.5 feet.

The head of navigation is 2.7 miles above this improvement at East Braintree, to which latter point the navigable length of Weymouth River from its mouth is 6.2 miles.

The freight carried on the river amounted in 1904 to 95,843 tons, and in 1907 to 179,551 tons, of which more than 87 per cent was coal. The increased depth obtained is of importance chiefly to the Fore River Ship Building Company, which builds at its extensive plant at Quincy Point large passenger and freight steamers, cruisers, and battle ships up to 20,000 tons. This company states that while no direct reduction in freight rates has been realized, the improved channel has proven of greater value and benefit in permitting the entrance of larger barges loaded with coal and lumber and the passage of vessels of greater draft between the harbor and the shipyards on the river.

The original project of improvement (above Weymouth Fore River bridge) is printed in the Annual Report of the Chief of Engineers for 1890, page 522. A report of the survey of the river (below Weymouth Fore River bridge) is printed in the Annual Report of the Chief of Engineers for 1904, pages 891–898.

July 1, 1907, balance unexpended	$6,013.10
June 30, 1908, amount expended during fiscal year for works of improvement	1,547.30
July 1, 1908, balance unexpended	4,465.80
July 1, 1908, outstanding liabilities	1,700.00
July 1, 1908, balance available	2,765.80

(*b*) *Weymouth Back River.*—In its original condition Weymouth Back River had a practicable channel not less than 200 feet wide and not less than 12 feet deep at mean low water from its confluence with Weymouth Fore River, 8,000 feet to the wharf of the American Agricultural Chemical Company, except on its bar, 400 feet across, one-fourth of a mile above its mouth, where the depth was 11 feet, and except the 2,000 feet next below that wharf, where the depth gradually shoaled from 12 feet to 6 feet at mean low water.

The original project adopted by a proviso in the act of August 18, 1894, which is also the existing project, is to dredge in Weymouth Back River a channel 12 feet deep at mean low water 200 feet wide through the bar and to extend the channel 12 feet deep at mean low water and 200 feet wide 2,200 feet to the wharf of the American Agricultural Chemical Company, at an estimated cost of $22,000.

The amount expended on this project is $22,000 (including $1,521.32 for maintenance), with which the channel has been dredged to the dimensions authorized by the project. After the completion of the improvement, by the application of the remaining funds in maintenance during the past fiscal year the full depth of channel previously dredged was restored with the width of 175 feet through the bar near the mouth of the river and 180 feet thence to the head of the improvement. The present deficiency in width is due to deterioration of the portion of the channel dredged in 1897, and the amount estimated as a profitable expenditure for the fiscal year ending June 30, 1910, will be applied to restoring the full width of the improved channel.

The maximum draft that can be carried at mean low water over the shoalest part of the locality under improvement is 12 feet. The mean range of tides is 9.4 feet.

The head of navigation is about 4 miles above the bar at the mouth of the river, and about 3 miles above the wharf of the Chemical Company, which is the upper limit of the improvement.

The commerce benefited by the improvement comprised, in 1906, 136,560 tons, and in 1907 169,756 tons, of which about seven-eighths was raw and manufactured fertilizer products.

A report of the survey of Weymouth Back River is printed in the Annual Report of the Chief of Engineers for 1891, page 683.

July 1, 1907, balance unexpended		$10,142.12
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$8,620.80	
For maintenance of improvement	1,521.32	
		[illegible]142.12
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		5,000.[illegible]

CONSOLIDATED.

July 1, 1907, balance unexpended		$16,155.22
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$10,168.10	
For maintenance of improvement	1,521.32	
		11,689.42
July 1, 1908, balance unexpended		4,465.80
July 1, 1908, outstanding liabilities		1,700.00
July 1, 1908, balance available		2,765.80
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		[a]5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix B 12.)

13. Hingham Harbor, Massachusetts.—In its original condition the channel leading to Hingham, south of Ragged and Sailor islands, was very narrow and crooked and obstructed by sunken rocks and shoals, over which the least depth was 4 feet at mean low water, while the available width of channel was but 30 feet.

The original project, adopted by the act of March 3, 1875, was to widen and deepen the natural channel by dredging and blasting to the width of 100 feet and depth of 8 feet at mean low water from deep water near the head of the harbor to the steamboat wharf, a distance of about 2,500 feet, at an estimated cost of $11,000. This improvement was completed in 1884, with the expenditure of $9,316.58, all for improvement, allotted from the appropriation for improving harbor at Boston, Mass.

The existing project, adopted by the act of August 5, 1886, and completed in 1893, is to deepen the improved channel 100 feet wide to 10 feet at mean low water and remove a mid-channel ledge, in the lower channel between Chandlers and Ragged islands, at an estimated cost of $18,750. By the act of March 2, 1907, without previous estimate, $10,000 was appropriated for redredging the channel.

In accordance with the desire of local commercial interests, active steps toward the application of this appropriation have been suspended awaiting action by Congress to make the funds available for extension instead of maintenance of channel.

To June 30, 1908, $19,327.72 (including $327.72 for maintenance) has been expended under the existing project.

The maximum draft that can be carried June 30, 1908, over the shoalest part of the locality under improvement is 8½ feet at mean low water. The mean range of tides is 9.5 feet.

The commerce benefited by the improvement consists of coal and building materials, of which 16,313 tons was received during the calendar year 1907, slightly more than the freight reported received in 1883; but the line of Boston passenger steamers which at the time the improvement was made landed at the pier at the head of the improved channel has long since been discontinued.

[a] For Weymouth Back River.

The original project, with survey of the harbor, is in the Annual Report, Chief of Engineers, for 1875, Part 2, page 417. A report of the survey upon which the present project is based is in the Annual Report for 1885, page 555, and a map of the harbor in the report for 1888, page 456.

July 1, 1907, balance unexpended	$9,680.98
June 30, 1908, amount expended during fiscal year for maintenance of improvement	8.70
July 1, 1908, balance unexpended	9,672.28

(See Appendix B 13.)

14. Harbor at Scituate, Mass.—In its original condition the depth on the bar was about 2.5 feet at mean low water, and the entrance was obstructed by many sunken bowlders; of the low-water area of about 57 acres, 6 acres had a depth of at least 3 feet at mean low water, and there was little protection against the sea.

The original project seems to have been to protect the beach between Cedar Point and the mainland on the northerly side of the entrance to the harbor, upon which, prior to operations under the existing project (in 1829 to 1852), $1,090.98 was expended in building 450 linear feet of brush and stone bulkhead and 385 linear feet of stone apron 10 feet wide.

The existing project, adopted by the act of June 14, 1880, is to build, of rubblestone, a north breakwater 800 feet and a south breakwater 730 feet long, to dredge an anchorage basin of 30 acres and an entrance channel 2,700 feet long and 300 feet wide, with depths at mean low water of 15 feet at the entrance, 12 to 15 feet between the breakwaters, 12 feet immediately back of the south breakwater, 10 feet in the anchorage basin, and 3 feet in the channel to the wharves, at an estimated cost of $100,000 for the breakwaters and of $190,000 for the dredging; total, $290,000.

Up to the close of the fiscal year ending June 30, 1908, there had been expended on the work under the existing project $103,500. Of this amount about $56,000 was expended for dredging, including about $9,500 expended from 1899 to 1901 in maintenance of the dredged channel. The amount previously expended for maintenance is not ascertainable.

With that expenditure all known bowlders obstructing the entrance to the harbor have been removed; the anchorage basin, 350 feet by 400 feet, has been dredged 7 feet at mean low water, and the channel from the sea to the basin has been dredged 7 feet deep, 100 feet wide, and 1,600 feet long; the channel, 2,150 feet long from the anchorage basin to the town wharves, has been dredged 3 feet at mean low water at least 100 feet wide; and 720 linear feet of the north breakwater and 450 linear feet of the south breakwater have been built.

Fifty per cent of breakwater construction and 21 per cent of the dredging authorized have been completed.

Through deterioration of the dredged channel, as reported by local interests, the channel depth has been reduced to less than 2 feet at mean low water. The mean range of tides is 9.8 feet.

The commerce benefited by this improvement consists of coal and building materials, of which about 15,000 tons was carried in 1902

and 8,087 tons in 1907. In 1883, prior to any dredging by the United States, the value of the annual commerce was reported to be $677,837, which had in 1907 declined to less than one-tenth of that sum.

In pursuance of a resolution of the Committee on Rivers and Harbors of the House of Representatives, the Board of Engineers for Rivers and Harbors in 1903 considered the project for this work, and in its report, published in the Annual Report of the Chief of Engineers for that year, pages 777–780, concurred in the opinion of the district officer that this place is not worthy of further improvement as a harbor of refuge, but in order to realize the greatest advantage from work already done, recommended the discontinuance of the present project for the improvement of Scituate Harbor and the adoption of a project for obtaining a channel 6 feet deep at mean low water and 100 feet wide from the entrance to the docks, at the cost of $18,000.

No appropriations have been made for this work for nine years past, and the district officer has reported that, by reason of the diminution in water-borne commerce, and the scarcity of light-draft vessels suitable for the authorized depth, the public benefits to be anticipated are entirely disproportionate to the cost of completing the improvement and the excessive cost of maintaining it. For these reasons no further estimate for the improvement of the harbor is submitted.

The existing project, as reported by a Board of Engineers September 18, 1880, with map of the harbor, is published in Annual Report of the Chief of Engineers for 1881, page 523.

Amount (estimated) required for completion of existing project.. $186,500.00

(See Appendix B 14.)

15. Harbor at Duxbury, Mass.—This harbor has two channels leading from deep water in the "Cow Yard" in Plymouth Harbor. The easterly channel to the east of Captains Hill is in Duxbury Bay, an extensive area of sandy shoals separated from the ocean by Duxbury Beach, a slender beach about 4½ miles in length; the westerly channel, known as the Miles channel, leads into Kingston Bay, west of Captains Hill.

In its original condition the easterly channel had a practicable width with a depth of 6 feet at mean low water to a point 2,600 feet from the wharf at Duxbury, in Duxbury Bay, and the Miles channel a depth of 8 feet at mean low water and a practicable width to a point 2,100 feet from the wharf at Duxbury, in Kingston Bay.

The original projects appear to have been—

1. For the protection of the beach, authorized by the act of July 4, 1836, by building groins of stakes and brush.

2. For the improvement of the channel, authorized by the act of June 10, 1872, to extend the Miles channel by dredging to the depth of 8 feet and width of 200 feet for a distance of 2,300 feet up to a point 200 feet above the wharf at Duxbury, in Kingston Bay.

On these projects there was expended prior to operations under existing project $25,000, with which some protection was given to Duxbury Beach, and the Miles channel was extended the aforesaid distance with the aforesaid depth and width.

The existing project, approved by the Secretary of War August 12, 1899 (a modification of a project submitted November 28, 1887), is to dredge a channel 6 feet deep at mean low water 60 feet wide, increasing to 100 feet on the curve, from the southerly wharf at Duxbury, in Duxbury Bay, 3,600 feet to the head of the easterly channel, at an estimated cost (as increased in 1899) of $17,820.

To the close of the fiscal year ending June 30, 1908, there had been expended under the existing project $12,000, all for improvement. With this expenditure the easterly channel has been extended with the depth of 6 feet the entire distance of 3,600 feet to the wharf, with a width of 80 feet at the wharf, 60 feet at the turn, and 40 feet elsewhere. The project is 81 per cent completed.

No survey has been made to determine the extent of the deterioration of the channel, but periodical reports from the only firm receiving water-borne freight show a gradual shoaling in the upper part of the channel until at the present time the maximum continuous depth at mean low water is but 1 foot. The mean range of tides is 9.3 feet.

In 1907 the commerce of the harbor, exclusive of fishing boats, consisted of 2,496 tons of coal and lumber, received for local consumption, the average receipts for the past five years being 2,329 tons. Although the depth of channel obtained in 1900 was sufficient to permit the passage of medium draft vessels engaged in the coal and lumber trade, no appreciable increase in water traffic occurred, and in view of the increasing difficulty of chartering vessels of suitable draft none is to be expected. It is the opinion of the district officer that the commerce involved is not of sufficient magnitude to justify the United States in undertaking the restoration of the channel or increasing the width as originally projected.

The project for beach protection, adopted in 1836, is in the Annual Report of the Chief of Engineers for 1866, Part 2, page 36.

The original project for improving the harbor is in Annual Report of the Chief of Engineers for 1872, pages 947 and 964.

The existing project (without modifications approved August 12, 1899) is in Annual Report of the Chief of Engineers for 1888, page 473, together with maps of the harbor. No map or description of the channel as modified under the project of 1899 has been published.

Amount (estimated) required for completion of existing project..... $5,820.00

(See Appendix B 15.)

16. Harbors of Plymouth and Provincetown, Mass.—(*a*) ***Harbor at Plymouth.***—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of $28,000.

Prior to operations under the existing project, $198,859.22 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount $60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor, from its course into the sea, to which it was changed by the storm. The estimated cost was $95,700.

The amount expended on the work of improvement under the existing project to the close of the fiscal year ending June 30, 1908, is $73,437.28, with which 11,843 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle; Eel River was restored to its former course, and 536 linear feet of stone dike was built to prevent the river from being again turned into the sea. In addition to the aforesaid amount expended under the present project, $3,954.42 has been expended for maintenance in redredging the turning basin, which had been dredged at the wharves under the project of March 3, 1875.

By way of refundment, $4,530.12 was collected as damages from the surety of a failing contractor.

In the report of January 20, 1899, submitting the project with estimate of cost, it was said:

> The following estimate for this work should be considered approximate only, for the reason that further changes are likely to occur before the work can be accomplished, which changes may materially increase or diminish the amount of work necessary to restore the beach to a safe condition.

The accretion of the beach before the stone dike was built materially diminished the cross section of a considerable part of it, and permitted its extension to protect other places where further erosion has occurred.

It is proposed to apply the available balance to repairing the riprap dike on the beach.

The commerce consists chiefly of coal and lumber, of which 33,354 tons was received in 1906 and 40,615 in 1907.

It is reported by the harbor master at Plymouth that the improvement of this locality by the United States has effected a saving of 50 cents per ton in freight rates.

The maximum draft that can be carried, June 30, 1908, at mean low water, over the shoalest part of the locality under improvement is 7.5 feet. The mean range of tides is 10.1 feet.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part 2, page 348. The project of 1899 is printed in the report for that year, page 1089. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

July 1, 1907, balance unexpended	$8,270.94
July 1, 1908, balance unexpended	8,270.94
Amount (estimated) required for completion of existing project	20,700.00

(*b*) *Harbor at Provincetown, Mass.*—This is an important harbor of refuge in the bight at the extremity of Cape Cod.

In its original condition the width and depth of its entrance and the depth of its anchorage were ample for the largest vessels, but actual or threatened inroads by the sea across the low and narrow part of the cape east of the town, and at intervals along about 1½ miles of the narrow beach southwest of the town, were a serious menace to the harbor.

The original project, adopted by the act of May 20, 1826, was "for the preservation of the point of land forming Provincetown Harbor."

The project from 1826 continuously to this date has been, by building dikes and groins and by other sand-catching devices, to arrest the erosion and promote the accretion of the barrier of beach and sand dunes which protects and preserves the harbor.

The amount expended to June 30, 1908, is $218,661.31, all applied to improvement.

The preservation of the harbor, whose importance as a harbor of refuge requires no elaboration, depends upon the maintenance of the barrier from Abel Hill to Long Point as a protection against westerly and southwesterly seas. Since the commencement of the improvement it has been sought to maintain this barrier by means of timber structures of temporary character, designed to catch and hold the sand moved by the sea and wind. Although in the vicinity of and below Wood End they have been partially successful in accumulating sand moved by the wind, for the greater part of the distance between Abel Hill and Wood End they have failed in the long run to accomplish their purpose, and now for a considerable part of this distance there exists between the ocean and the harbor only a light, sand-filled, wooden bulkhead, built on the beach whose crest is below the level of spring tides. The failure of these works may be attributed to absence of any great quantity of wind-driven sand, and to the inability of light timber structures to withstand the inroads of the sea. As a result of storms of the past winter, a portion of the beach is now in such a condition that temporary expedients can not be relied upon or expected to hold it through another winter of average westerly storms. For the security of the harbor a rubblestone dike is required across House Point Island flats from the vicinity of Stevens Point to a point northeasterly from Wood End Light, as shown in a general way on the map at page 576 of the Annual Report of the Chief of Engineers for 1886, estimated to cost $135,000, and to this purpose the appropriation asked for will be applied. It is recommended that provision for the entire work be made at one time, either by a single appropriation or by the continuing-contract system.

The maximum draft that can be carried to the anchorage is ample for the largest vessels.

The balance available will be applied to works of protection for preserving and strengthening the beach that preserves the harbor.

A description and plan of works are in the Annual Reports of the Chief of Engineers for 1876, 1879, 1886, and 1897, pages 181, 273, 574, and 878, respectively.

The commerce of this port is a small factor in this improvement compared with the preservation of this very excellent and important harbor of refuge.

July 1, 1907, balance unexpended	$10,428.59
June 30, 1908, amount expended during fiscal year for works of improvement	3,261.46
July 1, 1908, balance unexpended	7,167.13
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897.	135,000.00

CONSOLIDATED.

July 1, 1907, balance unexpended	$18,699.53
June 30, 1908, amount expended during fiscal year for works of improvement	3,261.46
July 1, 1908, balance unexpended	15,438.07
Amount (estimated) required for completion of existing project	20,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 135,000.00

(See Appendix B 16.)

17. Channel between North and South Hero islands, Lake Champlain, Vermont.—By the original project, adopted by the act of July 4, 1836, this channel, sometimes called the "Gut," was deepened by dredging to 8 feet at mean low water. The work was completed in 1839, at a total expense of $21,000.

In 1881 it was found by survey that the channel, about 1½ miles long, had an average depth of 10½ feet, with sufficient width, except that it was obstructed at its western entrance by a bar through which the channel was 40 feet wide and 7 feet deep, and at its eastern entrance by a bar through which the channel was 100 feet wide and 8 feet deep.

The existing project, adopted by the act of August 11, 1888, is to obtain a channel 150 feet wide and 10 feet deep at both entrances, at an estimated cost of $14,300. The dredging was done in 1889 and the channel reported as completed.

Since 1897 it has been reported that the western entrance to the passage was obstructed by a dangerous bowlder in mid-channel and that the channel was 1 to 4 feet shoal and 25 feet narrower than the project prescribed. A survey of the channel made in January, 1906, in connection with the complaint that the bridge of the Rutland Railroad Company is an unreasonable obstruction to navigation through the channel, shows that the channel has shoaled to the depth of approximately 7 feet at low lake level. Under an order of the Secretary of War requiring that company to alter its bridge or restore and maintain the authorized channel dimensions, the work of restoring the channel is very nearly completed.

To June 30, 1908, the amount expended under the existing project is $10,000, appropriated by the act of 1888.

[a] For Provincetown Harbor.

This channel is the main water connection between the commercial channel on the western side and Swanton Harbor and St. Albans Bay on the eastern side of the lake, and is generally used by steam and sailing vessels plying in that part of the lake, but the amount of commerce benefited by the improvement can not be accurately stated. Two steamers, carrying freight and considerable numbers of passengers, each pass through this channel twice daily during the season of navigation.

The existing project, with report of survey, is published in the Annual Report of the Chief of Engineers for 1897, page 3299.

18. Harbor at Burlington, Vt.—Before improvement there was ample depth of water along the docks and wharves, but they were without protection against wind and seas from Lake Champlain. In the greatest exposure during the prevalent northwesterly gales the wind has a sweep obliquely across the lake of about 10 nautical miles.

The original project, adopted by the act of July 4, 1836, was to build a breakwater parallel with the shore and about 1,000 feet from the docks and wharves.

Under the original and modified projects the amount expended for construction prior to the adoption of the project of 1886 was $501,811.07, with which 3,551 feet of breakwater was built.

The existing project, adopted in 1886, is to extend the breakwater 1,500 feet (500 feet northerly and 1,000 feet southerly), at an estimated cost of $150,000; enlarged in 1894 and 1902 to embrace repairs and replacing the crib superstructure (4,157 feet) with one of stone or concrete, at a cost estimated at $173,750, a total of $323,750.

The repair of the superstructure is being carried on under continuing contract for which the full amount authorized has been appropriated. In the execution of this work it developed that through deterioration of the timber cribs, the substructure on the lake face of the breakwater for a distance of 1,165 feet is in a serious condition as to stability. A rubble mound extending the full height of the substructure cribs, estimated to cost $52,000, should be built without delay to support and protect the lake face of the substructure.

Under the existing project there was expended to June 30, 1908, $210,507.10, of which $59,738.69 was applied to extending the breakwater 606 feet (364 feet northerly and 242 feet southerly), making the total length of the structure 4,157 feet. The remainder, $150,768.41, was applied to repairs and completing the rebuilding of 3,240 feet of superstructure, including $24,555 expended in repairing portions of the substructure thereunder, the necessity for which repairs could not be foreseen until the old superstructure was removed. From sales there was derived $146. The extension is 40 per cent and the rebuilding of the superstructure 78 per cent completed.

The extreme variation of level of water surface is 6½ feet and the usual variation about 4 or 5 feet.

Of the appropriation asked for, $52,000 will be applied to the construction of a rubble protection for the substructure of a portion of the breakwater, and $34,555 to rebuilding the superstructure in accordance with the project of 1902, this sum being the cost of substructure or foundation repairs which had to be made prior to the erection thereon of said superstructure. This maintenance work on the timber cribs of the substructure to the present time has required

the expenditure of $24,555 from funds on hand designed for continuing the rebuilding of the superstructure, and for like repairs to substructure now in progress $10,000 additional will be required.

The commerce amounted in 1904 to 107,421 tons, and in 1907 to 250,569 tons, of which, in 1907, nearly 80 per cent was lumber.

A description of the existing project for repairs and maintenance may be found in the Annual Report of the Chief of Engineers for 1901, page 1072, and a description and history of the work in the Annual Report for 1897, page 3296.

July 1, 1907, balance unexpended	$42,591.18
Receipts from sales	136.00
Amount appropriated by sundry civil act approved May 27, 1908	16,855.00
	59,582.18
June 30, 1908, amount expended during fiscal year for maintenance of improvement	26,588.28
July 1, 1908, balance unexpended	32,993.90
July 1, 1908, outstanding liabilities	6,073.95
July 1, 1908, balance available	26,919.95
July 1, 1908, amount covered by uncompleted contracts	6,019.32
Amount (estimated) required for completion of existing project	[c] 124,555.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[b] 86,555.00

(See Appendix B 17.)

19. Narrows of Lake Champlain, New York and Vermont.—In its original condition the 15 miles of this waterway extending from the northern terminus of the Champlain Canal, at Whitehall, northerly to Benson Landing, Vt., had a narrow and tortuous channel not more than 9½ feet to 10 feet deep on the shoals at low water.

The original project, adopted by the act of August 5, 1886, was to obtain, by dredging and by a small amount of rock excavation, a channel with a least width of 150 feet and depth of 12 feet at low

[c] Amount estimated required for completion of existing project:

Improvement—Extension of breakwater 900 feet (project of 1886) balance	$90,000
Maintenance, project of 1902—	
Expenditures for repairs to substructure or foundation prior to rebuilding the superstructure	24,555
Required for like repairs to substructure, now in progress	10,000
	124,555

[b] Appropriation recommended, for maintenance of improvement:

Repairs to substructure already made, see preceding note	$24,555
Repairs to substructure now in progress, see preceding note	10,000
Rubblestone protection for substructure	52,000
	86,555

water from Whitehall to deep water below Benson Landing, a distance of 15 miles. On the original project (as extended in 1890 to widen and straighten the middle reaches of the channel) the amount expended prior to operations under existing project was $63,500.

The existing project, adopted by the act of March 3, 1899, is to widen the channel and restore it to the depth of 12 feet at mean low water in five localities; also to provide fenders for protecting barges from collision with the rocky banks of the channel at Puts rock, the Narrows, and Pulpit Point, at an estimated cost of $22,500.

To June 30, 1908, the amount expended under the existing project was $24,015, including $15 for maintenance, with which the project has been completed. Available funds will be applied to maintenance of the improvement.

To June 30, 1908, the maximum draft that can be carried over the shoalest part of the locality under improvement is 12 feet at low water. The extreme variation of level of water surface is 6½ feet, and the usual variation about 4 or 5 feet.

From the foot of the canal at Whitehall to the head of Lake Champlain at Crown Point the navigable length of the Narrows is 37 miles. From Whitehall navigation is continued to the Hudson River and Erie Canal by the Champlain Canal, which is 65 miles long, from the southern extremity of the Narrows at Whitehall to Troy, N. Y.

The commerce consists principally of coal, pulp wood, building material, and general merchandise, and amounted in 1904 to 651,592 tons, and in 1907 to 724,529 tons.

The original project, with report and map of the survey of the channel, is published in the Annual Report of the Chief of Engineers for 1885, pages 2312 and 2315, and the existing project in the Annual Report for 1897, page 3302, and 1898, page 1046.

July 1, 1907, balance unexpended	$4,985.00
July 1, 1908, balance unexpended	4,985.00

(See Appendix B 18.)

20. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Wreck of schooner Phineas H. Gay at the entrance to Broad Sound, Boston Harbor, Mass.*—This vessel was sunk September 3, 1907, forming a dangerous menace to navigation. On December 23, 1907, the wreck had been removed under contract, at a cost of $500, to the required depth of 40 feet at mean low water, so that it was no longer a menace to navigation.

(*b*) *Wreck of schooner Julia A. Decker, in Newburyport Harbor, Mass.*—This vessel, which sunk September 15, 1901, when reported as a dangerous obstruction, lay on the north or Salisbury Beach side of the channel in Newburyport Harbor, about midway between the shore end of the north jetty and Badger rocks. It was removed under contract and completed December 20, 1907, at a cost of $750.

(*c*) *Wreck of canal boat F. W. Avery in Great Chazy River, N. Y.*—The larger portion of the wreck was lodged against the Coopersville highway bridge and the remainder against the center pier of the Delaware and Hudson Railroad bridge. The work of removal was completed on January 23, 1908, under contract at a cost of $500.

(*d*) *Wreck of schooner Helen F. Ward in Provincetown Harbor, Mass.*—This vessel was sunk in November, 1901, approximately 325 feet east-southeast from the beacon on old Union wharf. The removal of the wreck was completed April 13, 1908, under informal agreement at a cost of $150.

(*e*) *Wreck of steamer City of Birmingham, in Boston Harbor, Mass.*—This steamer sunk in Boston Harbor on November 4, 1907, on the southerly side of the 27-foot channel and about 1,800 feet northwesterly from Castle Island. Contract for its removal has been let and work is in progress at the date of this report.

(See Appendix B 19.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated October 24, 1907, and March 13, 1908, on preliminary examination and survey, respectively, of *Lynn Harbor, Massachusetts*, with a view to further improvement required by the river and harbor act of March 2, 1907, were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House Document No. 948, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $179,000 is presented.

The local officer was also charged with the duty of making other preliminary examinations and surveys provided for in the river and harbor act of March 2, 1907, as follows, and reports thereon will be duly submitted when received:

1. *Plymouth Harbor, Massachusetts.*
2. *Gloucester Harbor, Massachusetts.*
3. *Mystic River, Massachusetts.*
4. *Merrimac River, Massachusetts.*
5. *Burlington Harbor, "The Gut," and Harbor at St. Albans, Lake Champlain, Vermont.*

IMPROVEMENT OF RIVERS AND HARBORS IN THE NEWPORT, RHODE ISLAND, DISTRICT.

This district was in the charge of Col. J. H. Willard, Corps of Engineers, to February 28, 1908, and in the temporary charge of Maj. Harry Taylor, Corps of Engineers, since that date. Division engineer, Col. John G. D. Knight, Corps of Engineers.

1. *Harbor of refuge at Nantucket, Mass.*—This harbor is the only one between the harbors of Marthas Vineyard (Vineyard Haven and Edgartown) and Provincetown, a distance of 100 miles, except the small harbor of Hyannis, on the north side of Nantucket Sound. It has considerable area, with a depth of water in excess of 12 feet, and the object of the improvement is to make it a harbor of refuge for vessels plying between ports north and south of Cape Cod. Incidentally it forms a commercial harbor for the island of Nantucket, and it is the only one on the island. So far as known it has never been used to any extent as a harbor of refuge.

In its original condition the channel entrance was obstructed by a bar 1.5 miles in width, on which there was only 6 feet of water at

low tide, the channel being very crooked and subject to changes in location. Between 1829 and 1844 an ineffectual attempt was made to dredge a channel through the bar; $45,734.75 was expended prior to beginning operations under the existing project.

The present project, adopted in 1880 and modified in 1885, provides for the construction of two jetties, one on each side of the entrance, and for dredging when necessary, in order to obtain a channel depth of from 12 to 15 feet at low water. Estimated cost, $375,000, exclusive of cost of dredging.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1908, exclusive of outstanding liabilities, was $387,302.44, of which $7,210 was expended in repairs to the west jetty, $6,312.90 to the east jetty, and $50,000 in dredging.

About 83 per cent of the west jetty and 90 per cent of the east jetty have been constructed. A channel 200 feet wide and 12 feet deep at mean low water was dredged between the jetties during the working season of 1905.

The mean rise and fall of the tide is about 3 feet.

During an unusually severe storm in December, 1896, a breach was made through the Haulover beach between the ocean and the head of the harbor. The beach still remains open, and it is believed that its influence has been to retard the deepening of the jetty channel.

The depth of water in the passage through the Haulover beach is said by the fishermen using it to be somewhat less since dredging the jetty channel. It would be a benefit to the jetty channel to have this passage closed. Its closure, however, by any works at the Haulover would be a matter of very great expense, but increasing the waterway by dredging in the jetty channel will increase the navigation facilities and at the same time promote the closing of the breach at the Haulover.

A large portion of the 3,955 feet of the west jetty, built prior to 1884, has been damaged somewhat by storms and ice and, having no core of small stone, allows considerable sand to pass through it. This should be repaired so as to be as sand tight as possible and raised to its original height. It is estimated that $30,000 will be required to complete the repairs in addition to the estimated cost of the project.

The approved project for this work contemplates building two converging jetties and the excavation by dredging of so much of the channel as may not be deepened by the tidal scour. The estimate of the approved project was $375,000 for the jetties alone. But the height above low water was left to be determined by experience, and it will be some years before the work can be considered as complete. Owing to the exposed situation, the character of the bottom, and the effect of ice, $13,522.90 of the appropriation for construction is properly chargeable to maintenance, for which no special allotment was made. Dredging, which was included in the project but not in the estimate, had been postponed year by year to observe the action of the jetties, but $50,000 for the purpose of dredging was first applied from the appropriation of March 3, 1905. The dredged channel, now about 200 feet wide and 12 feet deep at mean low water, should be increased in width from the deep water off Brandt Point in the inner harbor to the 12-foot contour at the jetty entrance, and the estimate

for completion includes $50,000 for that purpose, making a total increase in the estimate of cost of $100,000 on account of dredging.

Further work under the project will consist in raising the incomplete portions of both jetties as may be required, and widening the dredged channel, with a view to the extension and maintenance of the benefits to be derived from the improvement.

It is proposed to apply the amount estimated as a profitable expenditure to widening the 12-foot channel by dredging and to enlarging and strengthening such portions of the jetty as may be necessary.

The entire commerce of Nantucket is carried on at this harbor, amounting in 1907 to about 43,919 tons. The effect of this work will be to afford a place of refuge easy of access and secure from storms for coasters and fishing vessels.

For reference to reports containing more detailed information see Annual Report of the Chief of Engineers for 1905, page 76.

July 1, 1907, balance unexpended	$38,735.93
June 30, 1908, amount expended during fiscal year for works of improvement	36,711.62
July 1, 1908, balance unexpended	2,024.31
Amount (estimated) required for completion of existing project	101,312.90
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	80,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix C 1.)

2. Harbor at Vineyard Haven, Massachusetts.—Vineyard Haven is a deep indentation on the northern shore of Marthas Vineyard Island, on the southern side of Vineyard Sound.

The headlands on either side of the entrance to the harbor were gradually wearing away and the adjacent parts of the harbor were shoaling. The mean range of tide is 1.7 feet.

The existing project of April 11, 1888, as modified in 1889, provides for the protection of the "Chops" (or headlands) from erosion and the intervening harbor from being filled with the eroded material, the whole to be done by means of stone sea walls and jetties built along the beach in front of the bluffs at both headlands. The total cost was estimated in 1889 at $60,000, the whole of which has been appropriated.

The sum of $55,387.35 had been expended on this work up to June 30, 1908, by which there had been built a series of riprap jetties and sea wall, which appear to have afforded the needed protection.

This harbor, being at present the most accessible refuge for the immense fleet of coasting vessels plying between points north and south of Cape Cod, is more extensively used than any other on the southern coast of New England. Additional work in this locality would be for the extension of benefits.

For reference to former reports giving more extended information, see Annual Report of the Chief of Engineers for 1905, page 77.

Further work at this harbor will depend upon the action taken upon the report of the Board of Engineers provided for by the river and harbor act of June 13, 1902.

July 1, 1907, balance unexpended	$4,612.65
July 1, 1908, balance unexpended	4,612.65

(See Appendix C 2.)

3. Woods Hole channel, Massachusetts.—Woods Hole is a waterway or strait connecting Buzzards Bay and Vineyard Sound and lying near the southwestern part of Cape Cod, Massachusetts.

Before improvement in the strait the channels were crooked and obstructed by bowlders, and the velocity of the currents at certain stages of the tide was from 5 to 7 miles per hour. The site of the wharves and basins of the United States Fish Commission and Revenue-Marine Service was a submerged point of land from the shore of Great Harbor.

The original project of 1879 provided for making a channel through the bar at the entrance to Little Harbor and widening and deepening the channel through the strait. The project of 1883, extended in 1884 and 1886, provided for the construction of retaining walls on shore, a stone pier, and a wooden wharf, mainly for the use of the United States Fish Commission and incidentally for the use of other branches of the public service, all of which work had been completed prior to 1889.

The amount expended on the original and modified projects prior to beginning operations on the existing project was $113,599.92, by which the entrance to Little Harbor had been dredged to 10 feet depth, and a direct channel 9 feet deep had been dredged through the strait, where none previously existed. The retaining walls, stone pier, and wooden wharves at the United States Fish Commission had also all been built and repaired.

The existing project, that of June 3, 1896, provides for deepening the channel through the strait to 13 feet at mean low water and widening the same to 300 feet; estimated cost, $396,000.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1908, exclusive of outstanding liabilities was $149,820.11, resulting in the removal of all obstructing shoals, with the exception of a small point of rock which could not be dislodged by the dredge and will have to be removed with dynamite, and the removal of the small shoal off Mink Point, the northeastern extremity of Nonamesset Island. The portion of this shoal lying within the lines of the "Broadway channel" formed a partial barrier to its southerly entrance and its removal was regarded as properly within the scope of the existing project. A clear passage of 13 feet depth at mean low tide, with the slight exception noted above, now exists through the strait by both channels.

The mean rise and fall of the tide is about 4 feet at the Buzzards Bay end of the channel and 1.65 feet at the Vineyard Sound end.

The commerce of Woods Hole was about 27,100 tons for 1907, no account being kept of vessels passing through the strait.

The only work remaining to complete the existing project is the blasting away of the shoal spot referred to above.

The prices at which the contracts for this work have been let have been much less than the original estimates, and the relative proportion of the large bowlders to the smaller and lighter material less than the estimated amount based on previous work, so that the project will be completed for much less than the amount originally estimated.

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 79.

July 1, 1907, balance unexpended	$106,738.73
June 30, 1908, amount expended during fiscal year, for works of improvement	26,558.84
July 1, 1908, balance unexpended	80,179.89
July 1, 1908, outstanding liabilities	6,972.11
July 1, 1908, balance available	73,207.78

(See Appendix C 3.)

4. Harbors at New Bedford and Fairhaven, Mass.—New Bedford Harbor is an estuary of Buzzards Bay, the Fairhaven side of the harbor being called Fairhaven Harbor. New Bedford is the port of the cities of New Bedford and Fairhaven.

Before improvement the channel had a depth of 12.5 feet at mean low water. The improvement of this harbor has been carried on under a number of distinct projects, the first being the removal of a wreck and dredging the sand bar formed by it in 1836–1839, on which $10,000 was expended. The projects of 1874 and 1877 provided for a channel 300 feet wide and 15 feet deep at mean low water from the deep water just above Palmers Island to the wharves of New Bedford. This work was completed in 1877 at a cost of $20,000.

This was followed after 1887 by various projects in which the controlling depth was 18 feet at mean low water and comprised channels 200 feet wide from Buzzards Bay to New Bedford, about 150 feet wide along the city wharf front above and below the New Bedford and Fairhaven bridge, an anchorage area about one-half mile long and 600 feet wide on the northerly side of the main channel between New Bedford and Fairhaven, and a channel 250 feet wide leading from the anchorage area through the draw in the bridge to the wharves above with a turning basin above the bridge. The total cost of the 18-foot projects, which were completed in 1906, was $137,709.

The existing project was adopted by the river and harbor act of March 2, 1907, and provides for dredging channels 25 feet deep at mean low water, 300 feet wide from Buzzards Bay to New Bedford, 250 feet wide through the draw in the New Bedford and Fairhaven bridge, with a turning basin above the bridge, and an anchorage area of about 114 acres, 25 feet deep, between New Bedford and Fairhaven, at an estimated cost of $527,000. An appropriation of $100,000 was made and contracts authorized in the sum of $200,000, which has since been appropriated for prosecuting the work.

At the adoption of the existing project, 18 feet depth of water was available for vessels to reach the wharves of New Bedford, but the

channel was too narrow, the anchorage small, and the depth insufficient to accommodate the commercial demands of the port.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1908, was $90,210.95, exclusive of outstanding liabilities, by which the work of dredging was commenced August 21, 1907, under a continuing contract, and continued throughout the remainder of the fiscal year. About one-half the authorized work was done chiefly in the anchorage area and the channel leading to the drawbridge. The channel leading from Buzzards Bay to the anchorage area and the channel and turning basin above the bridge are included within the present contract and will probably be completed during the coming year, the former for a width of but 200 feet, to be subsequently widened to 300 feet under future appropriations.

Eighteen feet of water at mean low tide can now be carried from Buzzards Bay through the harbor to the deep water above the drawbridge connecting Fish and Popes islands and to the wharves above and below the bridge, a distance of 3.2 miles. A farther distance of about 2 miles up the Acushnet River is navigable, with a natural depth of from 6 to 15 feet of water.

The mean range of the tide is about 4.2 feet.

It is proposed to apply the amount estimated as a profitable expenditure to widening the channel and enlarging the anchorage area by dredging to the full projected dimensions. The additional work will be an extension of the benefits secured by the work now in progress.

The commerce of the harbor amounted to about 1,189,552 tons in 1907. The effect of the deep water on commerce is the use of deeper draft vessels than formerly, larger cargoes, and a consequent reduction in water freight charges.

For reference to reports containing more detailed information, see Annual Report of the Chief of Engineers for 1905, page 81.

The report of the survey of New Bedford and Fairhaven harbors, dated May 18, 1906, upon which the existing project is based, is printed as House Document No. 271, Fifty-ninth Congress, second session.

July 1, 1907, balance unexpended	$100,000.00
Amount appropriated by sundry civil act approved May 27, 1908	200,000.00
	300,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	90,210.95
July 1, 1908, balance unexpended	209,789.05
July 1, 1908, outstanding liabilities	70,535.93
July 1, 1908, balance available	139,253.12
July 1, 1908, amount covered by uncompleted contracts	118,154.24
Amount (estimated) required for completion of existing project	227,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908	227,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix C 4.)

5. Sakonnet Harbor, Rhode Island.—Sakonnet Point is a rocky headland on the eastern side of the mouth of Sakonnet River, and lies about 6 miles east of Newport. This point in connection with Churchs Cove forms an anchorage known as Sakonnet Harbor. Before improvement this harbor was protected from storms from the northeast, south, and southeast by the mainland, but was exposed to westerly storms. In 1827 a project was prepared for a breakwater 400 feet long at this point, and about 200 feet of this was built at that time. The project of 1899 provided for prolonging the old breakwater out to a rock nearly north of it and raising the whole to a height of 8 feet above mean low water. This project was completed in 1900 at a cost of $25,000.

The existing project, adopted by the act of March 2, 1907, provides for the removal of a rock from the harbor to the depth of 8 feet at mean low water at an estimated cost of $10,000.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1908, was $16.51, exclusive of outstanding liabilities, by which a contract for the removal of the rock had been entered into, and the greater portion of the work was done.

It is proposed to apply the available funds to the completion of the project.

For more detailed information, see Annual Reports of the Chief of Engineers for 1889, page 649; 1895, page 749; 1897, page 935; 1901, page 1126, and for the report on preliminary examination and survey upon which the existing project is based, page 1148 of the same report for 1901.

July 1, 1907, balance unexpended	$10,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	16.51
July 1, 1908, balance unexpended	9,983.49
July 1, 1908, outstanding liabilities	8.00
July 1, 1908, balance available	9,975.49
July 1, 1908, amount covered by uncompleted contracts	7,600.00

(See Appendix C 5.)

6. Taunton River, Massachusetts.—This river rises in Norfolk County, Mass., and empties into Mount Hope Bay at Fall River.

In its original condition the channel was narrow and obstructed by bowlders, and from Berkley bridge to Taunton the depth was in places not more than 5 feet at mean high water. A vessel of 30 tons burden was as large as could go up to Taunton. From 1870 to 1879 $63,000 was appropriated to secure 9 feet depth at high water. This work was completed in 1879.

The existing project, adopted July 14, 1880, provides for the widening and deepening of the river so as to secure a channel of at least 12 feet depth at high water, with 100 feet width from its mouth up to Berkley bridge (above Dighton); thence 12 feet depth with 80 feet width (100 feet width at bends) up to Briggs shoal; thence 11 feet depth with 80 feet width up to the "shipyard;" thence with 11 feet depth with 60 feet width up to Weir bridge, Taunton; all at a total cost estimated in 1893 at $125,000, all of which has been appropriated.

The amount expended on the existing project up to June 30, 1908, exclusive of outstanding liabilities, was $130,010.55 by which all projected work had been practically completed and the shoals offering the greatest obstruction to the navigation of the river had been redredged. About $24,000 of the above amount has been expended in the maintenance of the channel. Vessels of 11 feet draft can reach Taunton at high water, but at some points the 11-foot channel is very narrow. It is estimated that $5,000 every four years will be required to maintain the channel.

The head of navigation is at Weir bridge. No portion of the river has been improved above this point.

The mean range of the tide is about 5¼ feet at Dighton and 3.4 feet at Taunton.

With the $5,000 appropriated by the river and harbor act of March 3, 1905, for the purpose of redredging portions of the channel which have shoaled since the original dredging, a contract has been awarded for dredging a shoal opposite the stove-lining works at the lower end of Weir village and the removal of obstructing bowlders at points farther down the river. The contract will be made and work begun early in July.

It is proposed to apply the amount estimated as a profitable expenditure to dredging in such portions of the river as may shoal by freshets or otherwise.

The tonnage of 1907 was about 193,100 tons.

Further work on this river will be for the maintenance of benefits secured by the improvement.

For reference to reports giving more extended information, see Annual Report of the Chief of Engineers for 1905, page 82.

July 1, 1907, balance unexpended	$5,000.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	10.55
July 1, 1908, balance unexpended	4,989.45
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix C 6.)

7. *Sakonnet River, Rhode Island.*—Sakonnet River is an arm of the sea between the island of Rhode Island and the mainland, extending from the ocean to Mount Hope Bay, around the head of Rhode Island. Before improvement it was obstructed at its upper end by a causeway, known as the "Stone Bridge," extending across it. This causeway had two openings, one covered by a draw which was of insufficient width and depth for the needs of commerce, but the causeway offered such obstruction to the ebb and flow of the tides that the currents through the openings made the passage dangerous even to boats of such dimensions as could pass through them under ordinary circumstances.

The existing project, adopted June 3, 1896, provides for increasing the width and depth of the draw opening in the Stone Bridge, owned

by the State of Rhode Island, so as to provide an opening 100 feet wide and 25 feet deep at mean low water, estimated to cost $40,000.

Due to delay in securing necessary legislative action by the State of Rhode Island with reference to the Stone Bridge, no work had been done and no funds expended prior to May, 1905, when preliminary steps were taken. The work was finally completed October 3, 1905.

The amount expended on the existing project up to June 30, 1908, exclusive of outstanding liabilities, was $38,426.95, by which the work of enlarging the draw opening was completed.

While the passage of this point is greatly improved by the increased depth and width, the velocity of the current has not been materially reduced. The new drawbridge, which is to be of the bascule type, is not yet completed.

No further work is contemplated under the approved project.

July 1, 1907, balance unexpended	$3,060.43
June 30, 1908, amount expended during fiscal year for works of improvement	1,487.38
July 1, 1908, balance unexpended	1,573.05

(See Appendix C 7.)

8. Pawtucket (Seekonk) River, Rhode Island.—This river is the upper portion of the Providence River, the navigable portion extending from Pawtucket to Providence, a distance of 4 miles. Before improvement the channel in the river was narrow and had a ruling depth of about 5 feet at mean low water. Between 1867 and 1873 $52,000 was appropriated to dredge the channel to 7 feet depth. This work was finished in 1876. The project of July 5, 1884, provided for deepening the river so as to secure a channel of at least 12 feet depth at low water with 100 feet width from its mouth, at Providence, up to Grant & Co.'s wharf at Pawtucket, and thence 12 feet depth with 40 feet width, through a ledge rock for a short distance farther, to Pawtucket bridge, the head of navigation, all at a total cost estimated in 1883 at $382,500, of which $284,000 has been appropriated.

The river and harbor act of March 3, 1899, modified this project so as to provide for straightening that portion of the channel between Tenmile River and Bucklins Island. The project, with its modification, has been completed, with an expenditure of $282,444.91. This gave the channel 12 feet depth, but at a few points it has slightly shoaled and needs a small amount of dredging to restore the original depth.

The existing project, adopted by the river and harbor act of March 3, 1905, provides for deepening the channel to 16 feet at mean low water with 100 feet width and a channel through the ledge rock at Pawtucket of 16 feet depth at mean low water and 50 feet wide, at an estimated cost of $237,875.

The amount expended on the existing project up to June 30, 1908, was $308,282.60 by which a channel 16 feet deep was excavated through the ledge rock for a length of about 200 feet.

The river and harbor act of March 2, 1907, contains the following item:

Improving Pawtucket River, Rhode Island: Completing improvement, one hundred and thirty-five thousand five hundred and eighty-four dollars: *Provided*, That no part of this sum shall be expended unless the further amount of sixty-seven thousand seven hundred and ninety-two dollars shall be provided by the State of Rhode Island or other agency, and made subject to the order of the Secretary of War in such manner as he may direct, to be expended under his direction upon said project for its completion.

The general assembly of the State of Rhode Island passed an act making this appropriation, but—

Provided, That requisition for one-half of said sum shall be made on or after the first day of July, A. D. 1908, and requisition for the remainder of said sum shall be made on or after the first day of July, A. D. 1909, by said Secretary of War.

In accordance with the provisions of the act of March 2, 1907, proposals, to be opened July 22, 1908, were invited for all the work required to complete the existing project.

The mean rise and fall of the tide is about 5 feet.

The effect of the work thus far done on the new project is to facilitate the handling of vessels in Pawtucket Harbor, but the full benefit of the 16-foot channel will not be experienced until the project is completed.

The full capacity of the 12 feet depth of channel was utilized immediately on its completion and the demand for deeper water is now made in order that cargoes of coal coming from southern ports and carried only in the deeper draft barges may be taken to Pawtucket without the expense of lightering at Providence.

For reference to report containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 84. Reference to report on preliminary examination ordered by the river and harbor act of March 3, 1905, will be found on page 92 of the report for 1906.

July 1, 1907, balance unexpended	$141,619.43
June 30, 1908, amount expended during fiscal year for works of improvement	298.44
July 1, 1908, balance unexpended	141,320.99
July 1, 1908, outstanding liabilities	22.79
July 1, 1908, balance available	141,298.20

(See Appendix C 8.)

9. Providence River and Harbor and Narragansett Bay, and Green Jacket shoal, Rhode Island.—(*a*) *Providence River and Harbor and Narragansett Bay.*—The object of this improvement is to furnish a wide and deep channel for foreign and coastwise commerce from the ocean to Providence and to provide a deep-water anchorage for that harbor.

Before the improvement of the river in 1853 the available low-water depth was limited to 4.5 feet. Between 1852 and 1873, $59,000 was expended in securing first 9 feet and then 12 feet depth of channel.

The approved project of 1878, as modified in 1882, provided for deepening the river and deepening and widening its anchorage basins

so as to secure a channel of at least 25 feet depth at low water with 300 feet width from the deep water of Narragansett Bay up to Providence, R. I., and so as to secure anchorage basins of 20 feet depth with 600 feet width, 18 feet depth with 725 feet width, 12 feet depth with 940 feet width, and 6 feet depth with 1,060 feet width from Fox Point to Fields Point, all at a total cost estimated in 1882 at $675,000. This project was completed in 1895.

Another project originated in the river and harbor act of June 3, 1896, providing for securing a ship channel 400 feet in width and of a depth of 25 feet at mean low water from Sassafras Point, in Providence Harbor, through Providence River and Narragansett Bay by the most direct route practicable to the ocean by way of the "Western Passage," so called, at an estimated cost of $732,820. This project was put under the continuing-contract system and the amount expended on the work up to the close of the fiscal year ending June 30, 1908, exclusive of outstanding liabilities, was $476,210.28, by which the channel 400 feet wide and 25 feet deep had been completed from Sassafras Point to the deep water of Narragansett Bay by the Western Passage.

Under date of June 11, 1904, the Chief of Engineers authorized the use of $2,000 of the balance remaining on hand of the appropriation for securing a channel through the Western Passage of Narragansett Bay for the removal of certain obstructing rocks in Dutch Island Harbor, Rhode Island.

The total amount expended on projects previous to the existing project was $1,174,700.87.

The existing project, adopted by the river and harbor act of June 13, 1902, provides for an enlarged anchorage area of 25 feet depth, extending the full width of the harbor from Fox Point on the north and Long Bed and Sassafras Point on the south, including the area known as Green Jacket shoal, at an estimated cost of $607,778. This project was enlarged by the river and harbor act of March 2, 1907, so as to include an area of uniform width to the eastward of the main ship channel between Long Bed and Kettle Point, which is to be dredged to a depth of 25 feet at mean low water, for which $90,750 was appropriated, making the total estimated cost $698,528.

The river and harbor act of March 3, 1905, placed this work under the continuing-contract system, and a contract for the work has been entered into for dredging all the soft material from the projected anchorage area. The removal of a small amount of hard material in the southeast corner of the area is to form the subject of another contract after the overlying soft material has been removed.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1908, was $572,397.20, by which the soft material had been dredged from all that portion of the proposed anchorage area north of Long Bed, including Green Jacket shoal, about 60 per cent of the hard material forming that portion of Long Bed covered by the existing project, and about 92 per cent of the area to the eastward of the main ship channel between Long Bed and Kettle Point.

Further work under this project will extend the benefits secured thus far.

It is proposed to apply the existing balance to the completion of the existing project.

The improvement in general has been of great benefit to commerce, which in 1906 amounted to $3,086,003. No special benefit is apparent from the dredging in the Western Passage, which has shortened the channel a little for a part of the commerce of Providence.

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 85.

Reference to reports of examination and survey made in pursuance of act of March 2, 1907, will be found on page 97 of this report.

(*b*) *Green Jacket shoal.*—This shoal was in that part of Providence River which constitutes the harbor of Providence. It lay off the wharves on the south front of the city and occupied a part of the harbor that is required for anchorage purposes, covering an area of about 18 acres between the 15-foot curves and about 30 acres in all.

In its original condition the shoal in many places carried only 1 foot of water and was a very troublesome obstruction.

The project for the removal of this shoal was adopted August 5, 1886.

The sum of $104,250 was expended on this work up to June 30, 1904, by which 23.8 acres out of the original 30 of this shoal had been dredged to 25 feet depth, and a 16-foot depth had been secured over the central and largest portion of the shoal, in addition to a 20-foot depth in the main channel, making an important addition to the anchorage facilities of Providence Harbor.

In the river and harbor acts of June 13, 1902, and March 3, 1905, provision was made for the removal of the remaining portions of this shoal in connection with the project for an enlarged anchorage area in Providence Harbor, and all of the remaining portions of the shoal were removed under the appropriations made by these acts.

There has been some shoaling over those portions of the area dredged prior to this year, which probably extends along the eastern side of the recently dredged anchorage area. It is estimated that $15,000 will be required for the maintenance of this harbor during the fiscal year ending June 30, 1910.

The removal of the shoal enables vessels to anchor outside of the channel, and thus removes an obstruction to vessels going to or from the Providence wharves and to Pawtucket.

For reference to reports containing more extended information see Annual Report of the Chief of Engineers for 1905, page 85.

July 1, 1907, balance unexpended	$275,849.14
June 30, 1908, amount expended during fiscal year for works of improvement	149,718.34
July 1, 1908, balance unexpended	126,130.80
July 1, 1908, outstanding liabilities	41,248.88
July 1, 1908, balance available	84,881.92
July 1, 1908, amount covered by uncompleted contracts	48,689.14
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	15,000.00

(See Appendix C 9.)

10. Harbor at Fall River, Mass.—Fall River lies at the mouth of Taunton River, in the northeastern angle of Mount Hope Bay, which empties into the ocean through Narranganset Bay and Sakonnet River. It forms the port of entry of the city of Fall River, the largest cotton manufacturing city in the United States.

Before improvement the depth of water in the reentrant in the wharf line north of the Old Colony Steamboat Company's wharf was only about 6 feet, and a considerable area of the harbor, especially in front of the upper wharves, carried much less depth of water than existed in its approaches.

The project of 1874 provided for deepening an area in front of the wharves immediately north of the Old Colony Steamboat Company's wharf 160 feet wide to 12 feet, and an additional width of 100 feet to 11 feet at mean low tide. This improvement was completed in 1878 at a cost of $30,000.

The existing project, adopted by the river and harbor act of March 3, 1899, and enlarged by the act of June 13, 1902, provides for a channel 300 feet wide and 25 feet deep at mean low water along the city front between the Old Colony wharf and deep water at the upper end of the city front; also for a channel of the same dimensions through Mount Hope Bay to connect the deep water in front of the city with the deep water of Narragansett Bay, at a total estimated cost of $175,411.94. Provision was made in this act for placing the work under the continuing-contract system.

The sum of $175,412 had been expended on the existing project to June 30, 1908, by which the project had been completed.

The mean rise and fall of the tide is about 4.7 feet.

The improvement will give increased facilities for deeper draft vessels.

For reference to reports containing more extended information see Annual Report of the Chief of Engineers for 1905, page 86.

July 1, 1907, balance unexpended	$1,410.50
June 30, 1908, amount expended during fiscal year for works of improvement	1,410.50

(See Appendix C 10.)

11. Harbor at Newport, R. I.—This harbor is at the main entrance to Narragansett Bay, and all the year it serves as an easily accessible harbor of refuge to foreign and coastwise commerce.

Before improvement the capacity of the inner harbor was limited by shoals, and it was not adequate to the number and size of the vessels seeking it for refuge. The southern or main entrance was obstructed by a bar which stretched out from Goat Island and the northern entrance by a sharp, rocky spit near Rose Island, and the general business wharves of the city could not be reached at low tide by vessels drawing more than 8 feet. The mean tidal range is about 3.75 feet. Between 1873 and 1875, $28,500 was appropriated to secure 12 feet depth in the harbor. This work was completed in 1876.

The approved project, adopted in 1880 and modified in 1882, 1883, 1884, 1890, and 1895, provided for widening and deepening of the channel from Narragansett Bay into Newport, so as to secure 15 feet depth at mean low water with at least 750 feet width; for the extension of the 13-foot depth and 10-foot depth anchorage basins, and for

dredging a channel 10 feet deep along the State harbor line southward to opposite the gas company's wharf; for the partial cutting off of the shoal spit at the southern end of Goat Island, and for the construction of jetties on the western shore of Goat Island, so as to protect the end of this island from erosion and to prevent the drift of sand, etc., around the island into the adjacent parts of the harbor and channel, and for the removal of Spindle rock, a sharp, rocky spit near Rose Island; all at a total cost estimated in 1895 at $206,200.

The amount expended on the original and modified projects prior to operations under the existing project was $244,888.06, by which the projected work was completed.

The existing project, adopted by the river and harbor act of March 2, 1907, provides for dredging a channel 750 feet wide and 18 feet deep at mean low water around the southerly end of Goat Island and northward through the harbor, in accordance with House Document No. 121, Fifty-eighth Congress, second session, and for the extension of the 13-foot anchorage area southward to the harbor line and the removal of Nourmahal rock in Brentons Cove off the Fort Adams shore, to a depth of 18 feet, in accordance with House Document No. 438, Fifty-ninth Congress, second session, at a total estimated cost of $250,900, of which $85,000 was appropriated by the act of March 2, 1907, and $112,100 by the sundry civil act of May 27, 1908, leaving a balance to be appropriated of $53,800. The work is carried on under a continuing contract.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1908, was $76,907.30, by which the channel 750 feet wide and 18 feet deep through the harbor was completed and the removal of Nourmahal rock and the enlargement of the 13-foot anchorage area were commenced.

It is proposed to apply the existing balance and the amount estimated for profitable expenditure for the fiscal year ending June 30, 1910, to enlarging the 13-foot anchorage area in the southern part of the harbor, and the removal of Nourmahal rock.

The expenditure for the 18-foot channel is for new work and is to make that portion of the harbor available for that depth; the remainder of the proposed expenditures are for the extension of benefits already secured.

As the improvement of this harbor has progressed there has been a large increase in the size and number of vessels using it. It has become an important port of call for orders for the large coaling fleet of not only Narragansett Bay, but of the more eastern ports, and is the port of refuge for the fishing fleet as well as for landing and reshipment of the fish when the schools come upon this coast. At times the harbor is greatly crowded and a strong demand is made for a greater depth of water. The commerce for 1907 shows a tonnage of about 2,106,590 tons, principally fish, coal, and general merchandise. This includes freight passing through the harbor but destined for other ports.

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 87.

July 1, 1907, balance unexpended	$84,755.88
Amount appropriated by sundry civil act approved May 27, 1908	112,100.00
	196,855.88
June 30, 1908, amount expended during fiscal year for works of improvement	76,663.18
July 1, 1908, balance unexpended	120,192.70
July 1, 1908, outstanding liabilities	20,783.76
July 1, 1908, balance available	99,408.94
July 1, 1908, amount covered by uncompleted contracts	83,620.62
Amount (estimated) required for completion of existing project	53,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	53,800.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix C 11.)

12. Harbor of refuge at Point Judith, Rhode Island.—Point Judith is the southeastern extremity of South Kingston, R. I., and marks the southwestern entrance to Narragansett Bay. A long ledge, known as Squid ledge, extends for nearly a mile in a direction south by east about 1.5 miles west of the point.

At the adoption of the project this place was especially dangerous for vessels to pass during storms and even ordinarily bad weather.

The existing project of September 19, 1890, provides for the construction at this point of a national harbor of refuge nearly a mile square by means of stone breakwaters built partly on Squid ledge and planned so as to give protection against easterly, southerly, and westerly storms, the mainland itself forming a protection on the north, all at a total cost estimated in 1889 at $1,250,000. This project was modified by the report of a Board of Engineers convened to consider and report upon the construction of this harbor, which was approved November 16, 1896, and provided for raising the crest of the eastern arm and extending the western arm to its originally projected length, at an estimated cost of $444,311, and deferring the construction of the easterly detached breakwater as a part of the main project until the completion of the main breakwater should demonstrate its necessity or otherwise. The river and harbor act of June 13, 1902, made a further modification by providing for the construction of the easterly detached breakwater and continuing it to the shore, at an estimated cost of $196,193 for the detached breakwater and $187,558.80 for the shore extension. A further modification was made by the act of March 2, 1907, authorizing an extension seaward of the shore-arm breakwater at an additional estimated cost of $186,248.20, making the total cost of the shore arm $570,000 and a total estimate for the project and its modifications of $2,264,311.

The river and harbor act of March 2, 1907, provided for the further extension of the easterly shore arm of the breakwater under the continuing-contract system, appropriating $100,000 therefor and authorizing the expenditure of an additional $170,000 (appropriated by the sundry civil act of May 27, 1908) for its completion. Under date of May 11, 1907, a continuing contract was entered into for the

extension of the shore arm seaward. The work is to be completed within ten months after notification of approval exclusive of the months of December, January, February, and March. Work under this contract was commenced June 15, 1907, and suspended September 6, 1907, awaiting further appropriations. It was resumed June 18, 1908. The completion of this contract will complete the easterly shore arm and leave an easterly opening into the harbor 1,200 feet in width.

The sum of $1,626,993.62 had been expended on this work up to June 30, 1908, of which $6,417.32 was for maintenance. By this expenditure the main breakwater had been built to a total length of 6,970 feet with a height of 10 feet above mean low water, and the easterly shore arm had been completed for a distance of 1,353 feet out from the high-water line on shore to about 25 feet depth of water, with 110 feet forming the incomplete slope at the end, and about 650 feet additional running nearly west, of which 400 feet is about the high-water level and the balance submerged.

Before the construction of the breakwater the area inclosed within the lines upon which it has been built and the shore was about 640 acres, of which 390 acres has over 25 feet of water and 198 acres additional over 18 feet.

Proceedings for the condemnation of land required for the shore end of the breakwater are in progress. The decree condemning the land to the uses of the United States was entered on May 26, 1906, and the commission to assess the land damages viewed the land May 23, 1907.

A hearing was held before the commissioners at Narragansett Pier on August 14, 1907.

Six hundred and seventy-two vessels used the harbor of refuge during the year, of which 246 were schooners, 206 sloops, 70 barges, 70 steamers, 54 tugs, 11 yawls, 6 schooner yachts, 4 steam yachts, 3 sloop yachts, 1 knockabout, and 1 launch.

The unusually severe storms of the winter of 1907–8 accompanied by high tides damaged the main breakwater to a considerable extent, which should be repaired before another winter's storms. It is estimated that these repairs will cost $10,000.

It is proposed to apply the existing balance and the amount estimated for profitable expenditure for the fiscal year ending June 30, 1910, toward the completion of the easterly shore arm, and such other work as the available funds will permit.

The river and harbor act of March 2, 1907, provided for an examination with a view to further improvement of the harbor. The report of this examination was printed as House Document No. 911, Sixtieth Congress, first session, in connection with which matter House Document No. 935, Sixtieth Congress, first session, contains certain papers relating to Point Judith Harbor of Refuge, bearing upon its importance and the necessity for a landing pier at that place. No estimate is submitted for further work on the existing project for this locality pending action by Congress on the modified plan of improvement contained in the report of examination just mentioned.

July 1, 1907, balance unexpended	$118,157.74
Amount appropriated by sundry civil act approved May 27, 1908	170,000.00
	288,157.74
June 30, 1908, amount expended during fiscal year for works of improvement	95,107.75
July 1, 1908, balance unexpended	193,049.99
July 1, 1908, outstanding liabilities	25,326.23
July 1, 1908, balance available	167,723.76
July 1, 1908, amount covered by uncompleted contracts	131,955.36
Amount (estimated) required for completion of existing project	444,311.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix C 12.)

13. Entrance to Point Judith Pond, Rhode Island.—Point Judith Pond is a shallow salt pond, lying in the rear of the sandy beach of the Rhode Island shore, just west of Point Judith.

The improvement desired at this place by the people of the neighborhood is widening and deepening the present opening into the pond and the construction of jetties for the maintenance of such opening.

The State of Rhode Island and the town of South Kingston are making the opening into the pond.

No general project for the improvement of this channel has been formed. The appropriation of March 3, 1905, provided for the expenditure of $10,000 to assist in the work in process of execution by the local authorities. This was expended in extending and strengthening the western jetty at the ocean end of the channel.

The river and harbor act of March 2, 1907, provides $8,000 for "continuing improvement and for maintenance," "which amount shall be expended for dredging."

In 1905 the excavated channel through the beach proper was about 3,000 feet long and carried a navigable depth of about 6 feet, but for a like distance beyond this point there was practically no navigable depth at low tide, there being a wide sand bar crossed by irregular streams rarely carrying as much as 1 foot of water. On the pond side of this bar there was about 5 feet depth. The difference of level between the pond and the ocean, together with the relatively small sectional area of the channel, is such as to create very strong currents. No dredging through this bar would be permanent without some auxiliary directing works to control the flow of the current. An appropriation of $6,000 was made at the 1907 session of the Rhode Island general assembly, and it was expected that the use of the combined appropriations might result in some benefit to the work, but the threatened cutting away of the sand behind the westerly jetty at the entrance to the pond will probably make it necessary to use the State money in an effort to check this wash.

Up to June 30, 1908, $12,000 had been expended in surveys, for the expenses of the Board of Engineers authorized by the river and harbor act of June 13, 1902, and for the extension of the west jetty.

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 90.

July 1, 1907, balance unexpended	$8,000.00
July 1, 1908, balance unexpended	8,000.00

(See Appendix C 13.)

14. Harbor of refuge at Block Island, Rhode Island.—This island is about 14 miles east of the eastern end of Long Island, and about 10 miles distant from the nearest point of the mainland.

The object of the improvement is to furnish a harbor of refuge for medium-draft vessels engaged in foreign and coastwise commerce.

Before the construction of the present harbor Block Island had no harbor at all.

The mean tidal range is about 3 feet.

Between 1870 and 1876, $285,000 was appropriated for a breakwater for a harbor for medium-draft vessels, this work being completed in 1878. Between 1880 and 1882, $25,000 was appropriated for dredging an inner basin and the protection of the shore next to the breakwater, this work being completed in 1884. In 1884, $15,000 was appropriated for additions to the old breakwater, this money being so spent and the work completed in 1884–85.

The project of 1884, as modified in 1888, provided for the construction of a harbor of refuge on the eastern side of the island, consisting of an enlarged inner harbor (or basin) 800 feet square for small vessels and an exterior harbor for larger ones, at a total cost estimated in 1888 at $75,000. This project was practically completed in 1893.

The total expenditure prior to commencing work on the existing project was $399,000.

The existing project of June 3, 1896, provides for raising the entire breakwater to proper height and stopping sand leaks between certain points and dredging the main inner harbor to a depth of 10 feet, at an estimated cost of $83,985.

At the adoption of the present project this harbor was neither large enough nor well enough protected for the proper harborage of the craft seeking refuge at this place during storms and bad weather.

The sum of $119,171.75 had been expended on the existing project up to June 30, 1908, of which $17,839.74 was for maintenance. By this expenditure the entrance to the inner harbor, which had shoaled up from the drift of sand, had been partially dredged to a depth of 12 feet and redredged to a depth of 10 feet several times. The north wall of the enlarged inner harbor had been strengthened and repaired and the existing project completed. The accumulation of sand along the westerly side of the breakwater, as noted for a number of years, continues, and it is estimated that $12,500 would be required to remove the existing bar to the depth of 10 feet at mean low water.

The completion of the project provides an anchorage of about 17 acres, with a least depth of 10 feet at mean low water, 10 acres of which is within the walls of the enlarged inner harbor.

Reference to reports of an examination and survey made in pursuance of act of March 2, 1907, will be found on page 97 of this report.

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 91.

July 1, 1907, balance unexpended	$21,966.08
June 30, 1908, amount expended during fiscal year for works of improvement	21,246.66
July 1, 1908, balance unexpended	719.42
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	12,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix C 14.)

15. Great Salt Pond, Block Island, Rhode Island.—The Great Salt Pond is located about the center of Block Island and contains an anchorage area of 150 acres for vessels drawing 18 feet and over. The work of converting the pond into a harbor of refuge by making a channel through the beach on the west, connecting it with deep water in the ocean, was started by the State of Rhode Island and the town of New Shoreham.

The channel, under the existing project of June 3, 1896, as modified in 1900, is to be 600 feet wide and have a central depth of 25 feet for a width of 150 feet, sloping gradually to 12 feet in a width of 504 feet, the channel seaward to be protected on the south by a jetty extending to 350 feet beyond the original 18-foot contour, and on the north by a jetty about 1,200 feet long, and the sides of the channel where it passed through the original beach to be protected by stone revetments and sand fences, at a total estimated cost of $305,000.

At the time the work commenced under the General Government a channel of varying width and depth had been dredged with the money appropriated by the State and town, which would permit of 12-foot draft being carried in.

The south jetty had been built out 837 feet, and a north jetty 250 feet long had also been built, but at a distance of 720 feet from the south jetty instead of 600 feet, as called for in the adopted project.

The mean rise and fall of the tide is about 3 feet.

Up to June 30, 1908, $191,151.41 had been expended by the General Government on the existing project, of which $9,803.24 had been used for maintenance and repair. By this expenditure the south jetty had been extended 439 feet beyond the originally projected length, making a total of 1,691 feet from the initial point on shore. Some damage done by a severe storm in the spring of 1900 had been repaired. The 25-foot deep channel 150 feet wide had been completed, and a cut 23 feet deep and 30 feet wide had been made on either side of it, that on the northerly side of the channel going but about half way through. The 18-foot depth had been dredged to a width of 300 feet.

There remains to complete the existing project the construction of jetties as planned and dredging to secure the widths and depths projected, and the appropriation asked for will be applied to this work.

The work required to complete the existing project is for the purpose of extending the benefits of the improvement.

For reference to reports containing more extended information, see Annual Report of the Chief of Engineers for 1905, page 92.

July 1, 1907, balance unexpended	$32,791.91
June 30, 1908, amount expended during fiscal year for works of improvement	23,943.32
July 1, 1908, balance unexpended	8,848.59
July 1, 1908, outstanding liabilities	7,600.60
July 1, 1908, balance available	1,247.99
Amount (estimated) required for completion of existing project	105,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	105,000.00

(See Appendix C 15.)

16. Removing sunken vessels or craft obstructing or endangering navigation—steamer Queen City, schooner James S. Steele, barge Excelsior, barge Expounder, schooner Demozelle, schooner Rebecca Shepard, schooner Jesse Barlow, schooner Alice T. Boardman.

(*a*) *Steamer Queen City*, of 115 gross tons, burned and sunk in Sakonnet Harbor, Rhode Island. Removal completed September 24, 1907.

(*b*) *Schooner James S. Steele*, Gloucester fisherman of 78 gross tons, sunk on the Middle Ground shoal, Vineyard Sound, Massachusetts. Removal completed October 10, 1907.

(*c*) Unknown barge sunk near Watch Hill, R. I., afterwards found to be the barge *Excelsior*. Removal completed November 23, 1907.

(*d*) *Barge Expounder*, sunk on the western side of Providence Harbor below Sassafras Point, Rhode Island. Removal completed December 7, 1907.

(*e*) *Schooner Demozelle* (British), sunk near the western entrance to Vineyard Sound, Massachusetts. Unsuccessful attempts were made to locate the wreck by sweeping between December 9 and 14, 1907. Wreck had probably been destroyed by storms.

(*f*) *Schooner Rebecca Shepard*, 411 gross tons, sunk on Pollock Rip shoal, at eastern entrance to Nantucket Sound, Massachusetts. Removal completed January 2, 1908.

(*g*) *Schooner Jesse Barlow*, 276 gross tons, sunk near Pollock Rip light ship at eastern entrance to Nantucket Sound, Massachusetts. Removal completed January 11, 1908.

(*h*) *Schooner Alice T. Boardman*, sunk in Hyannis Harbor, Massachusetts. Removal completed February 4, 1908.

The amount expended during the year on the removal of wrecks is $4,709.31.

(See Appendix C 16.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination and survey of harbor of refuge, Block Island, Rhode Island, with a view to securing a greater navigable depth and a larger anchorage area.—Reports dated September 26, 1907, and January 18, 1908, respectively, are printed in House Document No. 828, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $132,000 is presented.

2. Preliminary examination and survey of Wickford Harbor, Rhode Island, with a view to obtaining a depth of 15 feet, and for the removal of a ledge known as General rock.—Reports dated July 22, 1907, and January 22, 1908, respectively, are printed in House Document No. 905, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $56,800 is presented.

3. Preliminary examination and survey of Providence River, Rhode Island, with a view to extending the deep-water area to Kettle Point.—Reports dated July 1, 1907, and February 4, 1908, are printed in House Document No. 919, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $184,800 is presented.

4. Examination of Point Judith Harbor of Refuge, Rhode Island.—Report dated January 22, 1908, is printed in House Document No. 911, Sixtieth Congress, first session. A project for improvement at an estimated cost of $921,502.80 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE NEW LONDON, CONNECTICUT, DISTRICT.

This district was in the charge of Maj. Harry Taylor, Corps of Engineers. Division engineer, Col. John G. D. Knight, Corps of Engineers.

1. Pawcatuck River, Rhode Island and Connecticut.—The navigable part of the Pawcatuck River extends 5 miles from Westerly, R. I., to its outlet, in Little Narragansett Bay, through the northern part of which a navigable channel extends 2½ miles to Stonington Harbor, Connecticut, through which Long Island Sound is reached.

Before improvement the channel of the river was crooked and obstructed by numerous shoals, on some of which there was 1 to 1½ feet of water, and the greatest depth that could be carried through the bay channel was 4½ feet.

The original projects, that of 1871 for the river channel and that of 1879 for the channel across the bay, provided for depths of 5½ and 7 feet and widths of 75 and 200 feet, respectively. The expenditure on the original projects was $97,500.01.

The present project, adopted in 1896, provides for a channel 10 feet deep from Stonington, Conn., to Westerly, R. I., with a width of 200 feet from Stonington to Avondale, R. I., a distance of about 4 miles; a width of 100 feet from Avondale to the lower wharves at Westerly, a distance of about 3 miles, and a width of 40 feet between the upper and lower wharves of Westerly, a distance of about one-half mile, at a total estimated cost of $200,361.60. The river and harbor act of March 3, 1905, authorized the use of $1,000 of the appropriation for the improvement of the Pawcatuck River in the removal of obstructions at Watch Hill, at the southeastern part of the Little Narragansett Bay. The greater portion of the obstructions was removed in January and February, 1906, at a cost of $865.82.

On this project $52,540.25 had been expended to June 30, 1908, therewith completing the section 40 feet wide along the wharves of Westerly, extending the 100-foot channel downstream 1,800 feet, and making a part channel through Little Narragansett Bay. Of this amount $15,114.58 was applied to maintenance. The project is about 25 per cent completed.

The maximum draft which could be carried June 30, 1908, was 8.5 feet in the bay channel, 7 feet in the river, and 6 feet near Watch Hill. The mean rise of tide is 2.6 feet at the mouth of the river and 2.3 feet at Westerly.

The effect of the improvement is to permit coal, lumber, and building material to be delivered in vessels at Westerly, and to ship therefrom granite in vessels instead of by rail, thus giving water competition for these materials, with a resulting benefit in the reduction of freight rates.

The available balance and the appropriation asked for will be applied toward maintenance and the completion of the project.

The reported tonnage for 1907 was 47,589, valued at $357,868.34.

July 1, 1907, balance unexpended		$33,345.33
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$7,150.54	
For maintenance of improvement	735.05	
		7,885.59
July 1, 1908, balance unexpended		25,459.74
July 1, 1908, outstanding liabilities		3,633.17
July 1, 1908, balance available		21,826.57
July 1, 1908, amount covered by uncompleted contracts		20,069.21
Amount (estimated) required for completion of existing project		138,342.01
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		15,000.00

(See Appendix D 1.)

2. *New London Harbor, Connecticut.*—New London Harbor, which comprises the lower 3 miles of the Thames River, has a navigable width of one-quarter to 1¼ miles and depth of 26 feet or more in the main channel from Long Island Sound to the railroad drawbridge which crosses the river above the New London dock front. This channel, especially opposite New London, follows the east bank. Between it and the city docks is a nearly level area having a general depth of 10 to 15 feet. Before improvement part of the docks were accessible to vessels of 16 to 18 feet draft at high tide only.

The original and present project, adopted by the act of June 13, 1902, provides for dredging and maintaining a ship channel 400 feet or more in width, 23 feet deep, and about 6,000 feet long. This channel leaves the deep water of the river opposite Fort Trumbull on the west side, skirts the water front of the city, including that of Winthrop Cove to the Central Vermont Railroad bridge and the east side of the Central Vermont dock, and joins the natural deep channel at a distance of about 4,000 feet upstream from the point of beginning. The estimated cost of the improvement was $145,000, and $1,000 per

annum for maintenance. For map see House Document No. 392, Fifty-sixth Congress, first session.

Up to June 30, 1908, $141,080.59 had been expended on the project.

The project dredging was completed under a continuing contract in October, 1904. This completed the project except at two small areas of ledge rock in the Fort Trumbull-Shaws Cove arm of the channel, where there were depths of about 18 feet, and at a part of a city pipe sewer crossing the middle of the dredged channel, where the least depth was 21.6 feet. The rock in the channel was removed in 1907. A draft of 23 feet can be carried to opposite all the principal docks. The additional work proposed is to maintain the improvement.

The effect of this improvement has been to materially reduce freight rates.

The mean range of tide is 2.6 feet.

Under a modification of the existing Thames River project, adopted in 1892, Shaws Cove, a branch of New London Harbor, has been dredged to 12 feet.

The reported tonnage of this port for the year 1907, principally coal, building material, oil, and steamboat freight, and exclusive of that pertaining to Shaws Cove and Thames River, was 649,438, valued at $12,111,900.06.

Reference to reports on examination and survey made in pursuance of act of March 2, 1907, will be found on page 122 of this report.

July 1, 1907, balance unexpended	$13,149.08
June 30, 1908, amount expended during fiscal year for works of improvement	7,229.67
July 1, 1908, balance unexpended	5,919.41
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	3,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix D 2.)

3. Thames River, Connecticut.—This is a tidal stream from Norwich, Conn., the head of navigation, to Long Island Sound, a distance of 15 miles. For 4 miles below Norwich the natural depths were 6 feet or more at low water with widths of 400 to 1,000 feet. Below this point depths were 13 feet or more and widths 800 to 3,000 feet.

The original project, adopted in 1836, provided for a channel 11 feet deep at low water, to be secured by dredging and building dikes. On this project $40,300 had been expended when, in 1839, work was stopped, the project not having been completed.

The existing project, adopted June 23, 1866, and modified in 1879, 1882, 1888, 1892, and 1907, is to dredge and build training walls to secure a channel 200 feet wide with depths of 20 feet from New London to Allyns Point and 14 feet thence 5 miles to Norwich; also to dredge Shaws Cove at New London to a depth of 12 feet. Estimates of cost were $473,870 for construction and $9,500 annually for maintenance.

Up to June 30, 1908, $458,165.31 had been expended on this project and its modifications, of which $32,308.57 had been applied to maintenance. The proposed training walls had been completed; a chan-

nel had been completed to Allyns Point, 200 feet in width and 16 feet in depth; thence to Norwich the project depth of 14 feet had been secured in a channel varying in width from 100 to 200 feet; and the proposed dredging in Shaws Cove had been completed. The upper portion of the channel was redredged for maintenance during the year.

Mean range of tide is 2.6 feet at New London and 3.1 feet at Norwich.

With the balance on hand it is proposed to complete the project. The appropriation recommended will be applied to maintenance of the improvement.

Commerce at Allyns Point is coal, and at Norwich and intermediate landings it is mainly coal, lumber, cotton and wool, and steamboat freight. The reported tonnage for 1907 was 459,016, valued at $2,826,977.16, including 20,789 tons, valued at $126,462.80, for Shaws Cove commerce.

The work done has reduced the cost of transportation by enabling freight to be brought in vessels of 16 and 18 foot draft instead of 8 foot draft. The river commerce of the present day could not be carried except for the increased depths thus obtained.

The modification of project adopted by act of March 2, 1907, is printed in House Document No. 265, Fifty-ninth Congress, second session.

July 1, 1907, balance unexpended		$43,865.22
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$7,215.27	
For maintenance of improvement	7,215.26	
		14,430.53
July 1, 1908, balance unexpended		29,434.69
July 1, 1908, amount covered by uncompleted contracts		14,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		9,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix D 3.)

4. Connecticut River between Hartford, Conn., and Holyoke, Mass.—This portion of the river is 34 miles long, and is naturally divided into three distinct sections. From Hartford to the foot of Enfield Rapids, 10½ miles, the river has a gentle slope, with a sandy, shifting bottom; from the foot to the head of Enfield Rapids, 5½ miles, the total fall at low water is 32 feet, and the bed of the river is largely rock; from Enfield Falls to Holyoke, 18 miles, the river is of moderate width, gentle slope, fair depth, and stable bottom.

In its original condition the lower section had a navigable depth of 2 feet or less at low water; the second section could be navigated upstream only with great difficulty and only by boats of shallow draft; the third section was navigable by boats drawing 4 to 5 feet of water.

At Enfield Rapids a canal with locks 80 feet in length and 18 feet in width, designed for boats with draft of about 3 feet at low water, has been constructed by private enterprise as part of a water-power development scheme.

Prior to June 30, 1898, $93,059.70 was expended in the construction of wing dams and dredging to provide a temporary improvement below Enfield Rapids, and in extensive surveys and examinations which were made with a view to permanent improvement of the whole stretch from Hartford to Holyoke.

No work of improvement has been carried on in this section of the river since 1886.

A complete history of the improvement of this section of the river, up to that date, with maps and plans, is given in the Annual Report of the Chief of Engineers for 1878, pages 248–391.

Examinations and surveys with a view to future permanent improvement have been made under the river and harbor acts of June 3, 1896, June 13, 1902, and March 3, 1905. The Board appointed by authority of the last-named act suggested three plans of improvement other than those which had been already reported upon. One of these plans provided for dredging, the use of wing dams and training walls, and rock excavation from Hartford up to a point above the mills at Windsor Locks; thence by a new lock and the upper portion of the existing canal, and thence to Holyoke, at a cost of $1,465,600. This plan was approved by the Board of Engineers for Rivers and Harbors, provided that all rights claimed to be infringed by this work should be ceded to the United States without cost. The amount expended on this survey was $22,838.47.

The appropriation of March 2, 1907, is for the purpose of investigation and further examination, in connection with the recommendation of the Board of Engineers for Rivers and Harbors referred to, to determine what rights may be infringed and if they can be obtained without cost to the United States.

To June 30, 1908, the amount expended from the appropriation of March 2, 1907, was $210.32.

No permanent benefit has resulted from the work thus far done.

July 1, 1907, balance unexpended		[a] $14,068.78
June 30, 1908, amount expended during fiscal year	$177.27	
June 30, 1908, amount covered into the surplus fund of the Treasury	6,940.30	
		7,117.57
July 1, 1908, balance unexpended		6,951.21
July 1, 1908, outstanding liabilities		1.39
July 1, 1908, balance available		6,949.82

(See Appendix D 4.)

5. Connecticut River below Hartford, Conn.—The part of the river under improvement is 50 miles long from Long Island Sound to Hartford. Beyond Hartford the river is navigable, by means of a small private canal at Windsor Locks, Conn., 34 miles to Holyoke, Mass., although the navigation is limited by reason of low fixed bridges and the inadequacy of the canal. Before beginning improvement below Hartford the available depth over Saybrook bar at the mouth of the river was 7 feet, and thence to Hartford at the shoalest of the river bars about 5 feet.

The original project, adopted in 1836, provided for the removal of the Saybrook bar by dredging. Up to 1843 an 11 to 12 foot channel

[a] Includes $2,161.53 from the act of June 13, 1902, available for surveys only, and $4,946.95 from the act of March 2, 1907.

had been dredged 50 feet wide and 1,500 feet long, at a cost of $23,471.57. No further work was done until 1870, by which time the dredged channel had been nearly obliterated by storms and freshets.

A project for permanent improvement was adopted in 1870 and modified in 1873 and 1880, under which two jetties were built at Saybrook bar and dikes constructed at Hartford and Glastonbury bars; but operations under this project have been abandoned.

The existing project, adopted in 1887 and modified in 1890, provides for maintaining the navigable channel by completing two jetties at Saybrook bar to a height of 5 feet above high water, with top width of 6 feet and side slopes of 1 on 1; raising the training wall, nearly 3,700 feet long, at the Hartford bars as may be found necessary by experience, but not to exceed 15 feet above low water; dredging the channel between the jetties to 12 feet depth and width of 400 feet and maintaining the channel by annual dredging at the various river bars to about 10 feet depth at mean low water and to a width as near 100 feet as practicable, at an estimated cost—

For annual dredging	$10,000
Completing Saybrook jetties	60,000
Dredging channel between them	20,000
Raising Hartford dike	50,000
Total	140,000

For scope and history of the modifications see pages 120 and 121, Annual Report of the Chief of Engineers, 1900.

The act of June 13, 1902, authorized an expenditure of $1,000 for removal of obstructions at mouth of Salmon River, a tributary to the Connecticut River.

Up to June 30, 1908, $563,721.93 had been expended on this improvement, of which $325,395.08 had been applied to maintenance. The project is about 50 per cent completed.

The maintenance of the river-bar channels by annual dredging has been held paramount in the project. A channel 200 feet wide and 12 feet deep at mean low water, which has been dredged through Saybrook bar between the jetties, has been well maintained by the jetties, and annual dredging at the river bars has generally kept a half-width channel open so that Hartford-New York steamers and barges drawing from 9 to 11 feet, according to the river stage, have been but little detained, and then only at summer low river and before completion of the annual dredging. The maximum draft which could be carried at mean low water over the shoalest river bar on June 30, 1908, was 10 feet. The mean rise of tide is 3.6 feet at Saybrook jetties and on low river 1.5 feet at Hartford.

Sketches of the Connecticut River from Hartford to Rocky Hill and of Saybrook bar are printed in the Annual Report of the Chief of Engineers for 1885, page 636. The river from the Sound to Hartford is shown on Coast Survey charts 253–256.

The reported tonnage for the year 1907 amounted to 485,704 tons, mainly coal, lumber, building materials, and miscellaneous steamboat freight, valued at $12,349,420.

The work done has reduced freight rates to Hartford and lower river ports materially, and has also greatly facilitated the delivery of coal and other freight. Without the improvements there could be but little freight traffic on the river.

The available balance and the additional appropriation asked for will be applied to maintenance and continuing work on the approved project.

Notice, dated June 11, 1907, was served on the New York, New Haven and Hartford Railroad Company requiring removal of its old bridge over Connecticut River at Old Saybrook and Old Lyme, Conn., pursuant to the provisions of section 7 of act of Congress approved April 7, 1904, the said structure to be entirely removed by December 31, 1908.

July 1, 1907, balance unexpended		$55,293.98
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$6,651.80	
For maintenance of improvement	15,665.68	
		22,317.48
July 1, 1908, balance unexpended		32,976.50
July 1, 1908, outstanding liabilities		5,140.60
July 1, 1908, balance available		27,835.90
July 1, 1908, amount covered by uncompleted contracts		7,030.65
Amount (estimated) required for completion of existing project		95,665.68
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		40,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix D 5.)

6. Harbor of refuge at Duck Island Harbor, Connecticut.— Duck Island Harbor is a bay on the north shore of Long Island Sound about 7 miles west of the mouth of the Connecticut River and midway between the harbors of New London and New Haven.

The project for this improvement, adopted by the act of September 19, 1890, provides for the construction of three riprap breakwaters of 3,000, 1,750, and 1,130 feet length, respectively, inclosing and sheltering an area of about 115 acres, with two entrances. The project height of the breakwaters is 10 feet above low water, with crown of 10 feet and slopes of 2 on 3 outside and 1 on 1 inside. The estimated aggregate cost is $463,540. For map see Annual Report of the Chief of Engineers for 1887, page 644, and House Document No. 398, Sixtieth Congress, first session.

To June 30, 1908, $116,309.25 had been expended, of which $5,334.10 was for maintenance, and 2,697 linear feet of the west breakwater had been built, but with reduced cross section, extending westwardly from Duck Island to a low-water depth of 17 feet. The mean rise of tide is 3.8 feet.

No estimate is submitted for further work on the existing project for this locality, pending action by Congress on a modified plan of improvement contained in House Document No. 398, Sixtieth Congress, first session, based on examination and survey authorized by the river and harbor act approved March 2, 1907.

The project is about 25 per cent completed. The commerce to be benefited by this improvement is the passing commerce of Long Island Sound, which may find it necessary or convenient to seek shelter at this locality. Its value can not be satisfactorily estimated.

From February 1 to December 31, 1907, 949 vessels were reported as using the harbor of refuge.

July 1, 1907, balance unexpended	$3,892.75
July 1, 1908, balance unexpended	3,892.75
Amount (estimated) required for completion of existing project	349,540.00

(See Appendix D 6.)

7. *Branford Harbor, Connecticut.*—Branford Harbor consists of three distinct parts: The outer harbor, approximately 1 mile wide and three-quarters of a mile deep; the inner harbor, about half a mile in diameter, separated from the outer harbor by a series of rocks, the principal ones of which are known as "The Mermaids;" and the river, which empties into the inner harbor from the northeast. The natural low-water depths when improvement began were: At the outside of the outer harbor, 15 to 16 feet, gradually shoaling to 8 feet near "The Mermaids;" through the inner harbor from "The Mermaids" to the mouth of the river, 7 to 8 feet; up the river for a distance of 1 mile, nearly to the lower docks, 12 feet or more. From the lower to the upper docks the channel gradually shoaled and narrowed so that the controlling depth was less than 6 feet and the width 25 to 50 feet. At the upper dock the stream is crossed by an earthen causeway, in which there is a small drawbridge which is rarely opened, although the stream is navigable for small craft to a fixed bridge about one-half mile above. Since the adoption of the present project a very general and uniform shoaling of 1 to 2 feet has taken place in the inner harbor, so that the controlling depth between "The Mermaids" and the mouth of the river, the shoalest place in the channel, was only about 6 feet.

The orignal and present project, adopted by the act of June 13, 1902, and modified by the act of March 2, 1907, provides for an 8½-foot channel 100 feet wide in the upper part of the river between the lower and upper docks and through the shoals at the mouth of the river, at an estimated first cost of $13,000.

This project was completed July 30, 1907, at which time channels of full project dimensions had been dredged from the 8½-foot curve in the lower harbor through the inner harbor to the mouth of the river, and in the upper portion of the river from below the lower docks upstream to the upper docks.

This work greatly facilitates navigation, and the effect of the improvement has been to reduce freight rates.

The maximum draft that could be carried June 30, 1908, from the entrance of the harbor to the head of the projected channel was about 8 feet at mean low water. The mean rise of tide is about 6.5 feet.

For report of survey upon which the present project is based, see Annual Report of the Chief of Engineers, 1901, page 1189, et seq. Reference to reports on examination and survey made in pursuance of act of March 2, 1907, will be found on page 122 of this report.

The amount expended on this project to June 30, 1908, was $11,148.31, of which $1,684.18 was for maintenance.

The commerce of this harbor is mainly coal, molding sand and clay, iron, and lumber. The tonnage for the year 1907 amounted to 28,313 gross tons, valued at $136,052.39.

The available balance and the appropriation asked for will be applied to maintenance of the improvement.

July 1, 1907, balance unexpended		$8,126.36
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$4,603.85	
For maintenance of improvement	1,671.02	
		6,274.87
July 1, 1908, balance unexpended		1,851.49
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908		2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1890.

(See Appendix D 7.)

8. New Haven Harbor, Connecticut.—New Haven Harbor is formed by a bay on the north side of Long Island Sound, which extends inland about 4 miles and is from 1 to 2 miles wide. Mill and Quinnipiac rivers, navigable for about 1 and 3 miles, respectively, above their mouths, empty into the head of the harbor from the northeast. The original available low-water depth from the wharves to Cranes bar, one-third way down the harbor, was 9 feet; thence to Fort Hale, halfway down, it was 16 feet or over. Below Fort Hale was a broad bar of soft mud extending across the channel, with available depth of 13 feet. The harbor entrance was partly obstructed by several sunken rocks. In Quinnipiac River the available low-water depth was about 4 feet, and in the west branch of Mill River about 5 feet to the head of the present projected improvement. Above this point both rivers are for the most part available for navigation only at high tide. The entire east branch of Mill River ran nearly bare at low tide.

In 1870 a project was adopted for removal of sunken rocks at the harbor entrance. This work was not continued after 1875, when the harbor breakwaters were first proposed. In 1871 the project was extended to include deepening the harbor channel, the proposed depth and width being modified from time to time as appropriations were made until 1899, when the project provided for a channel 16 feet deep and from 400 to 700 feet wide from Long Island Sound to the head of the harbor and for a dike to contract the channel across Fort Hale bar, at a total estimated cost from beginning of $348,000. This project was nearly completed, the deficiencies being in the length of channel arm of the dike, which was about two-thirds the projected length, and in the width of the channel across Fort Hale bar, which was only 200 feet wide. The total amount expended on these projects was $325,695.66.

The last project, which was adopted by the act of March 3, 1899, provided for a channel 20 feet deep, 400 feet wide, and 4 miles long, from Long Island Sound to Canal dock; thence of same depth, 300 feet wide, one-half mile to Tomlinson bridge; three anchorage basins below Tomlinson bridge of 20, 16, and 12 feet depths; a channel up the Quinnipiac River 200 feet wide and 12 feet deep to Grand avenue, and a channel up the Mill River 12 feet deep and 200 feet wide to the junction of the two branches above Chapel street and thence 12 feet deep and 75 feet wide up each branch to Grand avenue. The act of March 3, 1899, making the first appropriation for this project, limited it to the portion below Tomlinson bridge, but the act of June 13, 1902, authorized the extension to the part above Tomlinson bridge, pro-

vided the cost should not exceed $345,000, the amount authorized by the act of 1899. The above project, including the improvement of the Quinnipiac and Mill rivers, except that part of the Quinnipiac River between Ferry street and Grand avenue, was completed April 26, 1904, mainly under continuing contract, and a channel 8 feet deep and 50 feet wide dredged in the Quinnipiac River between Ferry street and Grand avenue. The total appropriated for the project adopted by the act of 1899 amounts to $280,073.90, being less than the authorized cost of the project by $64,926.10. The entire project is about 80 per cent completed.

Mill River, where the worst shoaling had taken place, was redredged during the past year.

The available balance and the appropriation asked for will be applied to maintenance and to continuing the approved project.

For reference to maps and further details regarding the harbor and projects, see Annual Report of the Chief Engineers, 1904, page 94.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1908, was $306,294.80, of which $33,088.59 was for maintenance.

The maximum draft which could be carried June 30, 1908, through the main channel to Tomlinson bridge was 19 feet at mean low tide; above Tomlinson bridge the maximum low-water draft which could be carried up Mill River to Grand avenue bridge was 12 feet in both branches; up Quinnipiac River to Ferry street bridge, 12 feet, and from Ferry street bridge to Grand avenue a little more than 6 feet. The mean rise of tide is 6.5 feet at entrance to the harbor and 6.6 feet at Tomlinson bridge.

The work done has enabled deeper-draft vessels to use the harbor than was formerly possible, with the resulting reduction of freight rates due to the larger vessels and increased facilities for handling freight made possible thereby.

The commerce of New Haven Harbor is mainly in coal, steamboat freight, shellfish and shells, lumber, steel billets, and pig iron. The reported tonnage for the calendar year 1907 was 1,875,295 tons, valued at $31,824,711.82.

July 1, 1907, balance unexpended	$18,379.11
June 30, 1908, amount expended during fiscal year for maintenance of improvement	16,295.67
July 1, 1908, balance unexpended	2,083.44
July 1, 1908, outstanding liabilities	40.63
July 1, 1908, balance available	2,042.81
Amount (estimated) required for completion of existing project	64,926.10
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a] 20,000.00

(See Appendix D 8.)

[a] Including channel by way of Oyster Point to Kimberly Avenue Bridge on West River.

9. Breakwaters at New Haven, Conn.—The original and existing project for this work, authorized by act of March 3, 1879, and approved January 31, 1880, and modified by act of September 19, 1890, in accordance with plans given in Annual Report of the Chief of Engineers, 1889, page 678, is to make a harbor of refuge at the entrance to New Haven Harbor by constructing four breakwaters—one 3,300 feet long, extending from Southwest ledge to Quixes ledge; one 5,000 feet long, extending from a point 1,000 feet north 54° east from Ludington rock, in a direction south 54° west across the rock; one about 4,200 feet long, extending northwesterly from a point 6,000 feet south 54° west from Ludington rock, and one about 1,200 feet long, extending southwesterly from Morgan Point on the east side of the harbor entrance—the cross section of all these breakwaters to be 12 feet wide on top and 6 feet above mean high water, with outer slope 1 on 2 and inner slope 1 on 1. The estimated cost from the beginning, in 1880, was $2,151,134. The anchorage which will be sheltered by the breakwaters exceeds 2,000 acres, of which over 500 acres has depths of 20 to 28 feet, and the remainder is 9 to 20 feet deep. The mean rise of tide is 6.5 feet.

For original report on project, see Annual Report of Chief of Engineers, 1880, page 449 et seq., and for modification of project and maps showing the location of the breakwaters as contemplated under the existing project see Annual Report of the Chief of Engineers for 1889, page 678 et seq.; 1890, pages 624 and 625, and 1896, page 702.

At the close of the fiscal year the breakwater from Southwest ledge to Quixes ledge had been completed 3,450 feet long; 4,450 feet of the Ludington rock breakwater had been built, but with steeper slopes than called for by the project, and work was in progress on the west breakwater, which had been extended a total distance of 2,655 feet, of which the first 2,315 feet from the easterly end was very nearly completed and the remainder was at heights varying from about 25 feet below to 6 feet above low water. The project is about 50 per cent completed.

The total expenditure to June 30, 1908, was $958,929.55, of which $8,751.91 was for maintenance.

The commerce now benefited and to be further benefited by this work is mainly the passing commerce of Long Island Sound. The projected breakwaters provide also an outer anchorage for vessels bound to and from New Haven and help to protect the entrance to New Haven Harbor proper from seas and to diminish channel filling. For the calendar year 1907 some 6,708 vessels sought refuge behind the breakwaters. The additional work proposed is for extension of benefit to commerce.

The available balance and the appropriation asked for will be applied to continuing construction of the west breakwater and to maintenance.

The river and harbor act of March 2, 1907, authorized continuing contracts for the prosecution of this work to the amount of $250,000, all of which has now been appropriated; such a contract was entered into June 11, 1907. Work under this contract was begun September 4, 1907, and was in progress at close of fiscal year.

July 1, 1907, balance unexpended		$100, 3
Amount appropriated by sundry civil act approved May 27, 1908		150, 0
		250, 8
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$75, 702. 72	
For maintenance of improvement	4, 528. 40	
		80, 2
July 1, 1908, balance unexpended		170, 0
July 1, 1908, outstanding liabilities		23, 1
July 1, 1908, balance available		146, 9
July 1, 1908, amount covered by uncompleted contracts		124, 1
Amount (estimated) required for completion of existing project		1, 030, 8
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.		200, 0

(See Appendix D 9.)

10. West River, Connecticut.—This river lies between the cit New Haven and the town of West Haven. The head of naviga is at a railroad bridge about one-half mile upstream from the K berly Avenue Bridge. About 500 yards below this drawbridge river widens into a shallow bay and joins New Haven Harbor s of Oyster or City Point. The natural channel, about 2,000 y long through the middle of the bar, carried less than 3 feet a shoalest part. A channel leading from the harbor to docks at Oy Point had a controlling depth of 4.5 feet, but between Oyster P and the channel along the West Haven docks was a wide flat ne bare at low tide. The mean rise of tide is about 6.5 feet.

The project adopted by the river and harbor act of March 3, 1 provided for a 9-foot channel, 100 feet wide, from the downstr corner of the 16-foot anchorage basin of New Haven Harbor, Oyster Point and the dock frontage of West Haven, to Kimb Avenue Bridge, at a cost of $38,500, and $500 for annual mai nance.

To June 30, 1908, $38,500 had been expended on the project, a channel of project dimensions had been completed. The expe ture during the year was in settlement of expenses incurred du the previous year.

On June 30, 1908, a low-water draft of 9 feet could be carried f the 16-foot anchorage basin in New Haven Harbor upstream thro the Kimberly Avenue Bridge to the railroad bridge above, the dr ing between the two bridges having been done by private enterp The railroad bridge is a closed bridge, and no navigation is pr cable above this point except by small unmasted vessels.

The report of survey of West River is published at page 996 following, Annual Report of the Chief of Engineers, 1904, and survey map is printed in House Document No. 73, Fifty-eighth C gress, second session.

The effect of the improvement on freight rates, if any, is not kno

The principal articles of commerce are coal, oysters and shells, building material. The reported tonnage for the calendar year 1 was 125,873, valued at $1.025,014.88.

July 1, 1907, balance unexpended	$1,865.17
June 30, 1908, amount expended during fiscal year for works of improvement	1,865.17
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(See Appendix D 10.)

11. Milford Harbor, Connecticut.—This harbor is on the north shore of Long Island Sound, and consists of a broad, open bay, from the head of which a small tidal stream extends nearly a mile inland to the head of navigation. The original depth on the bar in the bay at the mouth of the river was less than 2 feet. In parts of the river the channel ran nearly bare. The mean rise of tide is about 6.2 feet.

The original project, adopted under the act of June 23, 1874, provided for a riprap breakwater 890 feet long from Welchs Point, on the east side of the mouth of the harbor, protection of the bluffs on the east shore from erosion by means of small stone jetties, a jetty on the east side to maintain the river-bar channel, and dredging a channel 4 feet deep and 100 feet wide across the bar, the whole estimated to cost $85,000. This project was modified in 1878 and 1879 to provide for extending the 4-foot channel 60 feet wide upstream to the town dock and for a training dike off Burns Point, on the west side of the river channel, nearly at right angles to the east-side jetty. The project thus modified was completed in 1880, except that the outer breakwater was not built, being deemed unnecessary in view of the provision of a harbor of refuge at New Haven. Under the act of June 14, 1880, a project was adopted for the extension of the 4-foot channel, 40 feet wide, upstream to the Straw Works wharf, and under the act of August 2, 1882, a revised project was adopted which provided for a channel 8 feet deep and 100 feet wide across the bar and upstream to Merwin's dock, at estimated cost of $11,000.

In 1891 these projects were reported as completed and no further work necessary, except maintenance of jetties and dredged channels. It was stated in July, 1895, that as a result of private dredging there was a clear channel across the bar 12 feet deep and nowhere less than 80 feet wide. On the previous projects $45,500, and for surveys $1,600, were expended.

For further details regarding former projects see Annual Report of the Chief of Engineers for 1893, page 929, and for report on which present project is based see Annual Report of the Chief of Engineers for 1900, page 1357 et seq. For map see House Document No. 280, Fifty-sixth Congress, first session.

The existing project, authorized by act of June 13, 1902, for completion at a cost of $15,000, consists in dredging and maintaining a channel across the bar and through the lower harbor, 100 feet wide and 10 feet deep, to Merwin's wharf, with an anchorage basin of same depth of about 5 acres area on the east side of the channel between the long dike and the harbor line, and a channel through the upper harbor from Merwin's wharf to the Straw Works wharf, 90 feet wide and 6 feet deep. The estimated cost for maintenance was $1,000 bi-

[a] See money statement under New Haven Harbor, Connecticut, page 106.

ennially. The first cost of the improvement was subsequently ascertained to be $25,000. The amount expended on this project to June 30, 1908, is $23,670.72, of which $21.10 was for maintenance.

The 6-foot channel has been extended upstream to a point about 500 feet above the town dock, a portion of the anchorage basin, about 2⅓ acres in area, adjacent to the 10-foot channel, dredged, and a basin, 1.6 acres in area, dredged on the opposite side of the channel opposite Merwin's wharf. Owing to ledge rock it was impracticable to complete this project within the estimate. The work done facilitates navigation in the lower part of the harbor, and the extension of the 6-foot channel to the town dock renders it practicable to land cargoes of coal at this dock, which it was formerly extremely difficult to do. The development of the anchorage basins greatly relieves congestion in the lower part of the harbor, due to the anchoring of small pleasure craft and oyster schooners in that portion of the harbor.

The available balance and the appropriation asked for will be applied to maintenance of the improvement.

On June 30, 1908, a low-water draft of 10 feet could be carried over the bar and up as far as Merwin's wharf, thence 6 feet draft to a point about 500 feet above the town dock, and thence draft of about 2½ feet can be carried to the Straw Works dock. No navigation is practicable above this dock.

The commerce of this harbor consists almost entirely of oysters, shells, coal, and fertilizer, the former predominating. The reported tonnage for the calendar year 1907 amounted to 23,989 tons, valued at $429,187.

July 1, 1907, balance unexpended	$1,350.38
June 30, 1908, amount expended during fiscal year for maintenance of improvement	21.10
July 1, 1908, balance unexpended	1,329.28
July 1, 1908, outstanding liabilities	2.74
July 1, 1908, balance available	1,326.54
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	2,000.00

(See Appendix D 11.)

12. Housatonic River, Connecticut.—This is a rapid river running southward through Massachusetts and Connecticut, emptying into Long Island Sound east of Stratford Point, about 5 miles east from Bridgeport Harbor. At Derby, 13 miles from its mouth, it receives the discharge of the Naugatuck River. Derby and Shelton are at the head of navigation. About a mile above there is a large power dam across the Housatonic River; above the pool of this dam the river is rocky and shoal.

The original depth on the worst bars in the river (6 in number) was from 3.5 to 4.5 feet. There was also a bar across the river mouth, with about 4 feet depth.

The original project for improvement, adopted under the act of March 3, 1871, provided for a jetty at Sow and Pigs reef; removing

Drews rock; a breakwater at the mouth of the river, and making a channel 7 feet deep, 200 feet wide through the bar at the mouth and 150 feet wide in the river, at total estimated cost of $404,961. In 1887 the estimates were revised, and a modification of the project proposed a breakwater or jetty at the mouth of the river 5,750 feet long, extending about south-southeast from Milford Beach 3,250 feet; thence parallel to and 500 feet from the channel 2,500 feet farther, to the 12-foot curve in Long Island Sound, the inner arm of the jetty to be 3 feet above mean low water, top width 6 feet, side slopes 1 on 1; the outer arm to be 6 feet above high water, top width 12 feet, outer slope 1 on 2, inner slope 1 on 1; and a channel 7 feet deep, 200 feet wide at the outer bar, and 100 feet wide through the river, at a total estimated cost of $202,000, and $4,000 annually for maintenance, all in addition to amount already expended. This modification was adopted under the act of August 11, 1888, and work on the breakwater was begun July 10, 1889. In 1893 the project was further modified to provide for building a small dike in the river below Stratford.

For maps see Annual Report of the Chief of Engineers for 1882, page 616, and for reports on various surveys and projects see Annual Reports of the Chief of Engineers for 1871, page 781; 1887, Part 1, page 607; 1888, Part 1, page 554.

The present project for improvement is the project of 1871, subsequently enlarged or modified as above, and the estimated cost from the beginning is $275,500.

Up to June 30, 1908, $262,473.22 had been expended on this project, of which $73,275.58 had been applied to maintenance. At that date the project was completed, except that the dike below Stratford was not built to the full projected length and the outer arm of the breakwater was only about 4 feet high above high water, 5 feet wide on top, and the side slopes much steeper than called for by the project. A channel of project dimensions had been dredged from the mouth of the river to Derby, but had deteriorated from the action of spring freshets and been redredged from time to time.

On June 30, 1908, 7 feet draft at mean low water could be carried across the outer bar and thence to Derby. The mean rise of tide at Derby is 4.2 and at the mouth of the river about 6.3 feet. The work done has enabled vessels to enter the lower river in safety instead of waiting for high tide in an exposed situation outside. A large part of the commerce could not have been carried on without the improved channel. The navigable channel to Derby materially reduces freight rates at that and adjacent towns, as otherwise all freight would have to be handled by rail and with no competition.

The commerce is largely in coal. A considerable quantity of oyster shells is shipped from near the mouth of the river. The reported tonnage for the calendar year 1907 was 81,163, valued at $428,691.83.

The available balance and the appropriation asked for will be applied to redredging at the bar channels, where needed, and in continuing work on the breakwater.

July 1, 1907, balance unexpended	[a]$20,006.87
June 30, 1908, amount expended during fiscal year for maintenance of improvement	10,030.09
July 1, 1908, balance unexpended	9,976.78
July 1, 1908, outstanding liabilities	156.29
July 1, 1908, balance available	9,820.49
Amount (estimated) required for completion of existing project	76,325.58
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1890.	41,000.00

(See Appendix D 12.)

13. Bridgeport Harbor, Connecticut.—This consists of a shallow bay, about 1 mile wide at the mouth and 1½ miles long, into the extreme northwest corner of which empties the Poquonock River, a small tidal stream navigable for about 1 mile, and into the northeast corner another small stream about three-fourths of a mile long, known as Johnsons River. Midway between these two streams is Yellow Mill Pond, a tidal basin about 1 mile in length. Black Rock Harbor, now considered part of Bridgeport Harbor, lies about 2¼ miles to the westward. Both harbors are inner portions of a large bay of Long Island Sound lying between the eastern part of Stratford Point and Fairfield reef. Black Rock Harbor is about one-half mile wide at the mouth and 1 mile long, with two branches at its head, the east one a mile long, known as Cedar Creek, and the west one about three-fourths of a mile long, known as Burr Creek.

The original low-water depths were as follows: On the bar at the mouth of Bridgeport Harbor, about 5 feet; in the Poquonock River from 2 to 5 feet; in Johnsons River, nearly bare in upper half; Yellow Mill Pond, generally bare; in Cedar Creek, 2 to 4 feet, and in Burr Creek, nearly bare.

Congress appropriated $10,000 in 1836 and an equal amount in 1852 for improving the main Bridgeport Harbor. These sums were expended in dredging near the mouth of the harbor, making channels 60 to 100 feet wide and 8 feet deep or more at low tide. The depth did not prove permanent. In 1871 and at various times thereafter the original project was enlarged to afford a 15-foot main-harbor channel, a 12-foot channel 200 feet wide in Yellow Mill Pond to Stratford avenue, a 9-foot Poquonock River channel, a 12-foot anchorage, and to protect the harbor entrance by two breakwaters, all estimated to cost $285,000. This project was completed in 1898, except as to capacity of the 15-foot channel.

The amount expended on the projects above named was $317,848.50.

At Black Rock Harbor, between 1836 and 1838, $21,550 was expended in building a sea wall across a breach in the southern part of Fayerweather Island. In 1884 a project was adopted for protecting the upper part of Black Rock Harbor by a breakwater about one-half

[a] The balance unexpended on July 1, 1907, as published in annual report, was in error 10 cents. The expenditures should have read $10,344.83 instead of $10,344.73, and the balance correspondingly reduced, making the correct balance unexpended $20,006.87.

mile long between Fayerweather Island and the mainland and for making a 6-foot channel 80 feet wide in Cedar Creek. The channel had been made, the breakwater built to full length, but with reduced cross section, and the project was considered as completed July 1, 1894. Subsequently repairs were made on the old sea wall on Fayerweather Island. The amount expended for Black Rock Harbor as a separate improvement was $72,900.

For details of original projects and their modifications see Annual Reports of the Chief of Engineers, 1902, pages 133 and 134, and 1903, pages 116 and 117.

In the act of March 3, 1899, Congress adopted a project for Bridgeport Harbor which provided, at an estimated cost of not exceeding $300,000, for—

First. The main channel, 18 feet deep, 300 feet wide from the outer bar to the inner beacon, thence 200 feet wide to the lower or Stratford Avenue Bridge across the Poquonock River.

Second. Three anchorage basins: One 18 feet deep, 500 feet wide, and 2,000 feet long adjoining the main channel on the west above the inner beacon; one 12 feet deep, 500 feet wide, and 900 feet long adjoining the main channel on the west between the 18-foot anchorage and Naugatuck wharf, and one 12 feet deep at east side of channel between the steel works point and the lower bridge.

Third. Poquonock River channel, from the lower bridge to the head of navigation, about 1 mile, 12 feet deep and 100 feet wide.

Fourth. Yellow Mill channel, from the main channel to the head of Yellow Mill Pond, about 1 mile, 12 feet deep and 100 feet wide.

Fifth. Johnsons River channel, from the main channel to the head of navigation, about 1¼ miles, 9 feet deep and 100 feet wide.

Sixth. Black Rock channel, from the head of Black Rock Harbor to the junction of Cedar and Burr creeks, thence up each of these creeks to the head of navigation, with lengths, respectively, of 1⅓ miles and one-half mile, 9 feet deep and 100 feet wide.

Seventh. The repair and maintenance of the outer and inner breakwaters of the main channel, and the one connecting Fayerweather Island with the mainland as now built, and the construction and maintenance of shore protection on Fayerweather Island to check the shifting of the beach.

An appropriation of $50,000 was made in the act cited and a continuing contract authorized, under which work was begun July 9, 1900, and carried on, with many interruptions and delays, until January 1, 1906, at which time the contract was 61 per cent completed. On account of the unsatisfactory progress this contract was annulled May 10, 1906, and the work relet. Work under the new contract was commenced July 25, 1906, and completed May 17, 1907, completing the project as authorized in 1899, except a section of Burr Creek, the inner end of Yellow Mill channel, and the inner end of Johnsons River, where, on account of ledge rock, the full project dimensions of the channels were not obtained.

The amount expended on this project to June 30, 1908, was $233,912.50, of which $33,026.91 was applied to maintenance, making the total expended on all projects prior to that now existing $624,661.

The act of March 2, 1907, authorized the extension of the project to include an anchorage basin 22 feet deep, 1,280,000 square feet in area opposite the inner breakwater, deepening the main entrance channel to 22 feet as far as the inner end of the 22-foot anchorage basin, an

additional 12-foot anchorage basin 608,600 square feet in area northwest of the 22-foot basin, and two breakwaters for the protection of the deep anchorage basin, at an estimated cost of $463,000. The act appropriated $113,000, and authorized continuing contracts in the additional sum of $350,000 for completing the project. Of this amount $310.000 is yet to be appropriated.

Reports of examination and survey containing the enlarged project are printed in House Documents Nos. 275 and 521, Fifty-ninth Congress, second session.

Under authority of the act of March 2, 1907, contracts for the construction of the breakwaters and for dredging the 12-foot anchorage basin have been made. The east breakwater has been completed and the west breakwater commenced.

The amount expended on the project of 1907 to June 30, 1908, was $54.630.87.

The maximum draft that could be carried June 30, 1908, through the improved channels at mean low tide is about 18 feet through the main channel from the outer end to the lower bridge; in the Poquonock River, about 11 feet; in the Yellow Mill channel, 12 feet; in Johnsons River, 9 feet; at Black Rock, 9 feet to the head of navigation in both branches of Cedar Creek; in Burr Creek, about 7 feet to its head. The mean rise of tide is 6.5 feet.

The balance on hand and additional appropriations will be applied to completing the project and to maintenance.

The work done has greatly facilitated the navigation of the harbor and made the present commerce possible and materially reduced freight rates.

The commerce of this harbor is chiefly in coal, lumber, iron, building material. petroleum products, oysters, and general merchandise. Tonnage reported for calendar year 1907 was 1,008,543 tons, valued at $15,594,225.62.

July 1, 1907, balance unexpended		[a] $121,858.72
January 4, 1908, allotted from act of March 2, 1907		10,000.00
Amount appropriated by sundry civil act approved May 27, 1908		40,000.00
		171,858.72
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$54,559.45	
For maintenance of improvement	10,191.14	
		64,750.59
July 1, 1908, balance unexpended		107,108.13
July 1, 1908, outstanding liabilities		18,471.40
July 1, 1908, balance available		88,636.73
July 1, 1908, amount covered by uncompleted contracts		30,311.36
Amount (estimated) required for completion of existing project		310,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908:		
For works of improvement	$100,000.00	
For maintenance of improvement	10,000.00	
		110,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix D 13.)

[a] The balance unexpended on July 1, 1907, as published in annual report, was in error $7.20. The expenditure for works of improvement should have read $117,230.40 instead of $117,223.20 and the balance correspondingly reduced, making the correct balance unexpended $121,858.72 as now reported.

14. Norwalk Harbor, Connecticut.—This harbor consists of the tidal part of Norwalk River extending from Norwalk, the head of navigation, to the river mouth, about 3 miles, and of an outer or main harbor lying between Norwalk Islands and the mainland. South Norwalk is on the west bank, about 1½ miles below Norwalk. The original depth in the river up to South Norwalk was about 5 feet; between there and Norwalk the river bed was nearly bare at low tide.

The original project, adopted under the act of June 10, 1872, and modified by the terms of the act of June 14, 1880, provided for a channel 100 feet wide and 8 feet deep from the outer harbor to South Norwalk, and thence 6 feet deep to Norwalk. This project was considered completed in 1892 at a cost of $83,000, although portions of the channel between Norwalk and South Norwalk were only 60 feet wide. The act of August 18, 1894, appropriated $15,000 for improving the inner harbor, and indicated the points where work was to be done. In accordance therewith a project was adopted for removing to 6 feet depth the shoal at Ferrys Point, below Norwalk, and, if funds permitted, for widening with depth of 9 feet the bend at Keysers Island, near the river mouth. This project was completed in 1897 at a cost of $15,000. A project adopted by the act of June 3, 1896, provided for a channel 10 feet deep and 150 feet wide from the outer harbor to South Norwalk, widening two points near the entrance, and the maintenance of this channel and the 6-foot channel between South Norwalk and Norwalk, at estimated first cost of $62,000, and $2,000 annually for maintenance. This project was completed October 3, 1905; the amount expended on it to June 30, 1908, was $36,833, of which $15,516.89 was expended for maintenance.

The present project, adopted by the act of March 2, 1907, provides for the restoration of the channel 10 feet deep and 150 feet wide to South Norwalk, for a channel 8 feet deep of a general width of 100 feet from South Norwalk to Norwalk, and for a channel 6 feet deep, 2,900 feet long, of a general width of 75 feet, to the docks at East Norwalk, and for maintenance of these channels, at an estimated first cost of $65,500, and $8,000 per annum for maintenance.

Under the present project the channel to South Norwalk has been redredged to full project dimensions, the East Norwalk channel completed, and the Norwalk channel partially completed. The amount expended on this project to June 30, 1908, was $27,231.01, of which $8,362.08 was expended for maintenance.

The maximum draft that could be carried at low water June 30, 1908, to the South Norwalk docks was 10 feet and to the East Norwalk and Norwalk docks 6 feet. The mean rise of tide is 7.1 feet.

For reference to reports and maps regarding this harbor and former projects, see Annual Report of the Chief of Engineers for 1904, page 103. For present project, see House Document No. 262, Fifty-ninth Congress, second session.

The available balance will be applied toward completing the channel between Norwalk and South Norwalk, and the appropriation asked for to maintenance of the improvements.

The commerce of this harbor is mainly in coal, oysters, lumber, wood pulp, building material, and general merchandise, and on all these items the improvement has effected a material reduction in

freight rates. The reported tonnage for calendar year 1907 amounted to 207,640 tons, valued at $5,473,911.01.

July 1, 1907, balance unexpended		[a]$63,444.67
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$18,813.60	
For maintenance of improvement	8,362.08	
		27,175.68
July 1, 1908, balance unexpended		36,268.99
July 1, 1908, outstanding liabilities		7,736.03
July 1, 1908, balance available		28,532.96
July 1, 1908, amount covered by uncompleted contracts		12,056.08
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		8,000.00

(See Appendix D 14.)

15. Harbors at Fivemile River, Stamford, Southport, Greenwich, and Westport, and Saugatuck River, Connecticut.—(*a*) ***Fivemile River Harbor.***—This is a tidal inlet about 1 mile long and from 100 to 1,000 feet wide. The natural low-water depth at the mouth was about 3 feet, shoaling to zero about halfway up the harbor and to about plus 2.5 feet at extreme head. The original and present project of improvement, adopted under authority of the act of August 11, 1888, provides for a dredged channel 8 feet deep and 100 feet wide, extending up the harbor about 6,000 feet from its mouth. The estimated cost from the beginning, as revised in 1894, was $45,000.

For further details regarding this harbor, see page 192, Annual Report of the Chief of Engineers, 1901.

Up to June 30, 1908, $39,789.94 had been expended on this project, of which $4,300 had been for maintenance. At that date a channel of project dimensions had been dredged about 5,400 feet up the harbor and thence about 200 feet farther with project depth and widths of 25 to 75 feet. No dredging has been done above this point. About 82 per cent of the project is completed.

The maximum draft that could be carried to the upper end of the improved channel is 8 feet, and no navigation is possible beyond this point except at high tide, when a draft of from 4 to 4½ feet can be carried about 1,400 feet farther to the head of navigation. The mean rise of tide is 7.2 feet.

The future appropriations will be applied toward maintenance and completion of the project by widening the channel to project dimensions and extending it upstream as funds permit.

The commerce of this harbor is mainly confined to the oyster industry, which could not be carried on to its present extent without the improved channel. Traffic reported for calendar year 1907 amounted to 10,248 tons, valued at $177,941.45.

[a] The balance unexpended on July 1, 1907, as published in annual report, was in error $4.50. The expenditures should have read $72.50 instead of $68.00, and the balance correspondingly reduced, making the correct balance unexpended $63,444.67, as now reported.

July 1, 1907, balance unexpended		$7,199.58
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$6,267.66	
For maintenance of improvement	721.86	
		6,989.52
July 1, 1908, balance unexpended		210.06
July 1, 1908, outstanding liabilities		.50
July 1, 1908, balance available		209.56
Amount (estimated) required for completion of existing project		9,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

(*b*) *Stamford Harbor.*—This consists of a bay on the north shore of Long Island Sound and of two tidal inlets known as the east and west branches, extending to the head of navigation at the city of Stamford. The original depth in the west branch was from 1 foot to 3 feet, gradually increasing in the bay to a depth of 12 feet. The east branch was originally a small marshy creek, deepened by private dredging to a depth of about 8 feet and which had shoaled so that when work was begun by the Government in 1892 the available depth was only about 6½ feet.

The original project, adopted under authority of the river and harbor act of 1886, was for a 5-foot channel 80 feet wide to the head of the west branch. This was considered completed in 1892 after an expenditure of $20,000, the channel being 5 feet deep and 100 to 140 feet wide at the bends, but only from 50 to 70 feet wide for the last thousand feet at the upper end.

The present project, adopted under authority of the act of July 13, 1892, provides for a channel in the west branch 7 feet deep, 150 feet wide, and about 1¼ miles long, with a basin of same depth between harbor lines at the head of the harbor and in the east branch, as approved October 5, 1892, a channel 9 feet deep and 100 feet wide for a length of about 8,535 feet and 50 feet wide for about 1,200 feet farther to the head of the harbor. The estimated cost was $123,500. A modification to give increased width at upper end of east branch was approved February 12, 1901.

For reports on surveys and projects, see Annual Report of the Chief of Engineers, 1884, Part 1, page 672; 1891, Part 1, page 849; 1893, page 954 (map, p. 956).

Up to June 30, 1908, $115,023.99 had been expended on this project, of which $32,511 had been for maintenance. At that date the channel in the east branch had been completed to full project dimensions; the channel in the west branch had been dredged to project dimensions from its outer end to the south end of the basin; a portion of the south end of the basin completed and a channel with a general width of 125 feet dredged along both sides and across the upper end of the basin. The available depth which could be carried June 30, 1908, to the extreme head of the west branch was 7 feet and 9 feet through the east branch channel to its head. The mean rise of tide is 7.4 feet.

[a] See consolidated money statement on page 121.

The available balance and the appropriation asked for will be applied toward maintenance and completion of the project.

The commerce of this harbor consists mainly of coal, lumber, stone, sand, clay, ores, and steamboat freight. The reported tonnage for calendar year 1907 amounted to 255,006 tons, valued at $8,772,217.59. Two daily lines of freight steamers, landing at the east branch, run to New York. The improvements made have rendered it possible for the steamers to run on schedule time and to enter the harbor at any stage of the tide, which they were unable to do previously, and have materially reduced freight rates.

July 1, 1907, balance unexpended		$57,924.20
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$25,840.22	
For maintenance of improvement	19,996.97	
		45,837.19
July 1, 1908, balance unexpended		12,087.01
July 1, 1908, outstanding liabilities		8,287.21
July 1, 1908, balance available		3,799.80
July 1, 1908, amount covered by uncompleted contracts		3,344.53
Amount (estimated) required for completion of existing project		28,900.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

(*c*) *Southport Harbor.*—This is a tidal part of Mill River at town of Southport, about 1 mile long and averaging less than 100 yards wide. The original depth was probably less than 2 feet at the entrance to the harbor, shoaling to about plus 1 foot at the upper end. Work was begun in this harbor by the Government in 1829 and prosecuted with various intermissions until 1878. During this time a dike inside and breakwater or jetty outside were built, and a channel 60 feet wide and 4 feet deep dredged across the outer bar. In 1878 a project was adopted for dredging a channel 100 feet wide and 4 feet deep across the bar and upstream 1,200 feet from the outer end of the jetty, and thence in a bifurcated channel to the nearest docks. In 1882 this project was reported as substantially completed, $31,587.23 having been spent since the beginning of work in 1829.

The present project, adopted by act of June 13, 1902, is to dredge a channel 6 feet deep through the outer bar to the upper docks 100 feet wide to the turn above White Rock, and thence in two branches, each 60 feet wide; to repair the breakwater and to remove two points of ledge from the channel to a depth of 7 feet. The original estimated first cost of this improvement was $13,200, and for yearly maintenance $300, to be expended biennially, but on account of the development of two additional outcroppings of ledge during the dredging it became evident that this estimate would be greatly exceeded before the work could be completed, and in 1906 the estimated cost was increased to $15,111 for this work.

For further details regarding this harbor and its former projects see Annual Report of the Chief of Engineers, 1897, page 986.

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[a] See consolidated money statement on page 121.

Up to June 30, 1908, $17,946.91 had been expended on this project, of which $1,376.43 had been for maintenance. At that date a channel of project depth and 75 to 100 feet width had been dredged to the turn above White Rock, and thence with full depth and widths of 40 to 60 feet up the east branch and along the dock front for about 200 feet; one point of ledge rock had been removed, and the breakwater repaired. About 55 per cent of the project is completed.

The maximum draft that can be carried through the improved portion of the channel is 6 feet. Above this point, where no dredging has been done, a draft of 3 to 4½ feet can be carried to the upper docks at low tide. Above the upper end of the projected channels the harbor is navigable only at high tide and for a distance of about half a mile. The mean rise of tide is 6.6 feet.

The improved channel permits vessels of not exceeding 6 feet draft to enter the harbor without being compelled to wait outside the bar in an exposed situation for the tide to rise.

The available balance and the appropriation asked for will be applied toward maintenance and completing the project.

The commerce of this harbor consists mainly of farm produce, general merchandise, oysters, and coal. The reported tonnage for calendar year 1907 amounted to 7,130, valued at $100,280.

The effect of the improvement on freight rates, if any, is not known.

July 1, 1907, balance unexpended	$2,139.06
June 30, 1908, amount expended during fiscal year for maintenance of improvement	196.97
July 1, 1908, balance unexpended	1,942.09
July 1, 1908, outstanding liabilities	1,942.09
Amount (estimated) required for completion of existing project	13,111.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*d*) *Greenwich Harbor.*—This is a shallow bay about 2 miles east from the New York State line, extending about a mile northward from Long Island Sound. The original low-water depth was about 6 feet to the lower docks. Above this point it shoaled rapidly to 3 feet 1,000 feet above and to about plus 2 at the head of the harbor. The original and present project, adopted in the act of June 3, 1896, is to dredge a channel 90 feet wide from the mouth of the harbor to the causeway at its head, a distance of about a mile, to be 9 feet deep to the steamboat dock and 6 feet deep above, the upper end to be enlarged to form a turning basin. The estimated first cost was $20,000. Page 860, Annual Report of the Chief of Engineers, 1895, gives report of examination upon which the project is based. Up to June 30, 1908, $20,578.18 had been expended on this project, of which $3,560.99 had been for maintenance.

This project was completed September 2, 1905. The work done has enabled vessels to enter the harbor with 9 feet draft at low tide, thus permitting the regular steamer to make trips without waiting for tide. Above the steamboat dock a draft of 6 feet can be carried

[a] See consolidated money statement on page 121.

at low tide to the head of navigation. The mean rise of tide is 7.5 feet.

The available balance and the appropriation asked for will be applied to maintenance of the improvement.

The commerce of this harbor consists mainly of coal, lumber, building material, and general merchandise. The reported tonnage for calendar year 1907 amounted to 80,730, valued at $3,334,400.

The effect of the improvement on freight rates, if any, is not known.

July 1, 1907, balance unexpended	$2,188.82
July 1, 1908, balance unexpended	2,188.82
July 1, 1908, outstanding liabilities	364.29
July 1, 1908, balance available	1,824.53
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*e*) *Westport Harbor and Saugatuck River, Connecticut.*—For description of these localities and statement of work under original project of 1826, and its modifications to about 1871, see Annual Report of the Chief of Engineers for 1901, page 189. The total amount expended for the same is $19,444.

The present project, adopted in 1892, originally provided for a channel 4 feet deep and 60 feet wide up to Westport, at an estimated cost of $10,000.

As a result of a survey authorized by the act of August 18, 1894, the project was modified in 1896 to provide for repairing the Cedar Point breakwater, removing a ledge opposite Stony Point, or dredging around it, and removing bowlders from the channel, at an estimated cost of $8,000, and the total estimated cost was in consequence increased to $18,000.

A sketch of this river and harbor is printed in the Annual Report of the Chief of Engineers for 1894, page 670, and report of the survey authorized in 1894 is printed in the Annual Report of the Chief of Engineers for 1896 and, with map, in House Document No. 67, Fifty-fourth Congress, first session.

The total amount expended on the present project up to the close of the fiscal year ending June 30, 1908, was $13,150.78, of which $96.92 was for maintenance. The 4-foot channel had been completed to Westport, head of navigation, with width generally of 60 feet, the ledge opposite Stony Point removed, and the Cedar Point breakwater repaired and extended. About 70 per cent of the project is completed. The mean rise of tide is about 7 feet.

Completion of the project requires further removal of bowlders and dredging to full project dimensions at the channel opposite Westport. Improvements made have rendered navigation of the river practicable at less than half-tide stages by vessels plying there.

Future appropriations will be applied to maintenance and the completion of the project.

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[a] See consolidated money statement on page 121.

The commerce comprises coal, lumber, farm produce, and steamboat freight. The reported tonnage for calendar year 1907 was 13,027, valued at $58,802.60.

The effect of the improvement on freight rates, if any, is not known.

July 1, 1907, balance unexpended	$2,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	150.78
July 1, 1908, balance unexpended	1,849.22
July 1, 1908, outstanding liabilities	1,849.22
Amount (estimated) required for completion of existing project	3,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

CONSOLIDATED.

July 1, 1907, balance unexpended		$71,451.66
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$32,258.66	
For maintenance of improvement	20,915.80	
		53,174.46
July 1, 1908, balance unexpended		18,277.20
July 1, 1908, outstanding liabilities		12,443.31
July 1, 1908, balance available		5,833.89
July 1, 1908, amount covered by uncompleted contracts		3,344.53
Amount (estimated) required for completion of existing project		54,311.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		63,311.00

(See Appendix D 15.)

16. Removing sunken vessels or craft obstructing or endangering navigation—Wreck of the schooner Eclipse.—This schooner, laden with 75 tons of coal, sunk April 11, 1908, in New Haven Harbor. The wreck and cargo were removed June 12, 1908, at a cost of $150.

(See Appendix D 16.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of Coscob Harbor, Connecticut, with a view to obtaining a sufficient depth to the drawbridge.—Report

[a] See consolidated money statement on this page.

dated March 22, 1907, is printed in House Document No. 74, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. *Preliminary examination of Branford Harbor, Connecticut.*—Report dated May 17, 1907, is printed in House Document No. 80, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

3. *Preliminary examination and survey of Connecticut River, with a view to removing obstructions in Eightmile River and East Branch, Connecticut.*—Reports dated May 9 and October 15, 1907, are printed in House Document No. 327, Sixtieth Congress, first session. East Branch is not considered worthy of improvement by the United States. A plan for improvement of Eightmile River at an estimated cost of $9,000 is presented.

4. *Preliminary examination and survey of New London Harbor, Connecticut, with a view to securing a depth of 15 feet in Shaws Cove.*—Reports dated May 7 and October 19, 1907, respectively, are printed in House Document No. 329, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $12,000 is presented.

5. *Preliminary examination and survey of harbor of refuge at Duck Island and for a breakwater at Kelseys Point, Connecticut.*—Reports dated April 29, and October 29, 1907, respectively, are printed in House Document No. 398, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $350,000 is presented.

The local officer was also charged with the duty of making preliminary examination and survey of *New Haven Harbor and Morris Cove, Connecticut*, provided for in the river and harbor act of March 2, 1907, and report thereon will be duly submitted when received.

IMPROVEMENT OF RIVERS AND HARBORS IN THE FIRST NEW YORK, NEW YORK, DISTRICT.

This district was in the charge of Col. John G. D. Knight, Corps of Engineers, division engineer, northeast division.

1. *Port Chester Harbor, New York.*—This harbor, situated at the boundary between the States of New York and Connecticut, consists of the tidal part of Byram River and of a bay at its mouth opening into Long Island Sound. The depth in the river before improvement was 1 foot, and Salt rock, in the river, and Sunken rock, in the bay, were considered to be dangerous obstructions.

The original project for this improvement was adopted in 1872 and modified in 1884 and 1888. It proposed to remove Salt rock to 9 feet below mean low water, to build a breakwater from Sunken rock to Byram Point, and to dredge and maintain a channel to the Port Chester wharves, at a total cost of $57,000. Up to 1899, at a total cost of $52,000, this project had been completed, except the dredging in the upper harbor.

The existing project, approved March 3, 1899, provides for a channel 12 feet deep at mean low water and 70 feet wide from deep water in the bay up to the town wharf, and thence 9 feet deep and 60 feet wide to the steamboat wharf, the work to be done by dredging and rock removal. Estimated cost, $25,000. By act of 1907 the project was extended to include removal of ledges of rock opposite the southerly point of Fox Island.

Up to June 30, 1908, $33,888.18 had been expended on the present project; of this amount $10,888.18 was for maintenance.

About 92 per cent of the work proposed under the present project has been completed and has resulted in securing a channel of the projected width and depth, except at and opposite the southerly point of Fox Island, where the width is reduced by ledges of rock to about 60 feet. The channel has deteriorated somewhat.

The available funds are to be applied to completing the improvement and to maintenance, and the additional appropriation recommended is to be applied to maintenance.

The maximum draft that could be carried June 30, 1908, at mean low water is estimated at 12 feet up to the town wharf; thence 9 feet to the steamboat wharf, and above the steamboat wharf 2½ feet. Mean range of tides, 7.4 feet. The head of navigation is at a fixed bridge at Mill street, about 900 feet above the steamboat dock. The total length of navigable channel from Long Island Sound to the bridge is about 1½ miles.

The tonnage and value of the commerce of this harbor, mainly in coal, building materials, manufactured goods, and farm produce, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1898	140,000	$4,986,000	1903	240,000	$3,940,000
1899	169,500	6,256,000	1904	255,000	4,590,000
1900	181,000	7,269,500	1905	293,000	7,365,000
1901	327,500	9,118,000	1906	265,000	6,870,000
1902	237,000	900,000(?)	1907	275,000	7,405,000

The commerce of this harbor has increased with the improvement. So far as has been ascertained, the improvement of this harbor has brought about a reduction in freight rates.

Detailed description of this improvement is printed in Reports of the Chief of Engineers for 1897, page 1084, and 1900, page 1378. Sketches of the river and harbor are printed in Reports of the Chief of Engineers for 1885, page 658, and for 1889, page 716.

July 1, 1907, balance unexpended	$6,500.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	888.18
July 1, 1908, balance unexpended	5,611.82
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	2,500.00

(See Appendix E 1.)

2. *Mamaroneck Harbor, New York.*—This harbor, situated on the north shore of Long Island Sound, consists of a narrow inlet opening into a shallow, broad bay. Before improvement the channel to the old steamboat wharf, half a mile up the inlet, had a depth of 5 feet at mean low water, gradually decreasing to 1 foot at the upper wharves. Various rocks at or near the mouth of the inlet obstructed navigation.

The present project, approved August 2, 1882, and modified April 27, 1899, provides for the removal of Round rock to a depth of 4 feet and Bush rock and Inner Steamboat rock to a depth of 7 feet at mean low water, and for making a channel 7 feet deep at mean low water and 100 feet wide from the harbor entrance to the upper wharves. Estimated cost, $43,000.

Up to June 30, 1908, $40,000 had been expended on this work; of this amount $4,628.50 was for maintenance.

About 82 per cent of the work proposed under the project has been completed, and has resulted in a channel with a uniform depth of 7 feet at mean low water and a width of from 70 to 100 feet from the harbor entrance to the turn at Hog Island, and thence 100 feet wide to the upper wharves. The channel has probably deteriorated somewhat.

The appropriation recommended is to be applied to completing the improvement and to maintenance.

The maximum draft that could be carried June 30, 1908, at mean low water is probably less than 7 feet. Mean range of tides, 8 feet. The head of navigation is at a fixed bridge just above the upper wharves. The total length of navigable channel from Long Island Sound is about 1 mile.

The tonnage and value of the commerce of this harbor, mainly in coal, building materials, and manufactured goods, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1896	29,095	$482,092	1903	26,230	$337,000
1897	51,673	877,180	1904	49,589	859,242
1901	20,705	51,598(?)	1905	54,944	201,398(?)
1902	48,495	75,000(?)	1906	15,756	131,000

It is not known that freight rates have been affected by this improvement, but it has facilitated the transportation of especially coal and building materials.

Detailed description of this improvement can be found in Report of the Chief of Engineers for 1900, page 1381. Sketch of harbor is printed in Report of the Chief of Engineers for 1903, page 859.

Amount (estimated) required for completion of existing project	$7,628.50
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix E 2.)

3. Larchmont Harbor, New York.—This harbor, situated on the northwest shore of Long Island Sound, 4 miles distant from New York City limits, is about half a mile wide and five-eights of a mile long. It is exposed to easterly and southerly storms. Two submerged rocks (Umbrella rock and Huron rock) formerly obstructed the entrance, which has a depth of 18 feet, gradually diminishing toward the head of the bay.

The original project for this improvement, adopted September 19, 1890, provided for building two breakwaters to protect the anchorage

ground, one to extend from Umbrella rock to Umbrella Point and the other from Huron rock to Long Beach Point, at an estimated cost of $105,000. Work under this project was suspended in 1891 after the first appropriation of $5,000 had been expended in commencing the two breakwaters.

The present project, adopted March 3, 1899, provides for building a breakwater extending southwardly 1,440 feet from the 6-foot curve off Long Beach Point and for the removal of Huron rock to a depth of 14 feet at mean low water. Estimated cost, $108,000. The project was extended by act of 1907 to include removal of ledges adjoining Huron rock.

Up to June 30, 1908, $64,528.02 had been expended on this project, all for improvement. There was received on bond of failing contractor, $6,905.04.

About 60 per cent of the work proposed under the present project has been completed, and as a result the breakwater has been built to full projected section to a length of 1,410 feet, and Huron rock and a portion of the adjoining ledge removed to depths of 14 and 12 feet, respectively.

The available funds are to be applied to completing the improvement and to maintenance.

The maximum draft that could be carried June 30, 1908, over the shoalest part of the entrance channel at mean low water is estimated at 18 feet. The general depth of the anchorage area of the harbor is from 6 to 12 feet at mean low water. Mean range of tides, 7.4 feet. The harbor is about half a mile wide and extends rather more than half a mile inland. It is a basin with no definite channel.

The harbor has but little commerce. It is mainly used by the Larchmont Yacht Club, by coasting and fishing vessels for night anchorage, and as a harbor of refuge.

Local freight rates are thought not to have been affected by the improvement.

Detailed description of this improvement is printed in Report of the Chief of Engineers for 1900, page 1383. A sketch of the harbor is printed in Report of the Chief of Engineers for 1903, page 860.

July 1, 1907, balance unexpended	$14,838.77
Collections from failing contractor	6,905.04
	21,743.81
June 30, 1908, amount expended during fiscal year for works of improvement	366.79
July 1, 1908, balance unexpended	21,377.02
Amount (estimated) required for completion of existing project	29,000.00

(See Appendix E 3.)

4. Harbor at Echo Bay, New York.—This harbor is on the north shore of Long Island Sound, 2 miles distant from New York City limits. It is landlocked, except toward the southeast, and has a good anchorage. Nearly all of the water transportation of the town of New Rochelle is carried on through this harbor.

The original project for improvement, adopted in 1875, provided for the removal of two ledges, known as Start rock and Sheepshead

reef, to 7 and 9 feet depth at mean low water, respectively, at an estimated cost of $38,955.38.

Prior to 1902 the sum of $22,000 had been appropriated, with which Start rock was reported wholly and Sheepshead reef partly removed to the projected depths, and a channel 40 feet wide and 4 feet deep at mean low water was dredged from Beauford Point to within 300 feet of the head of the harbor.

The project adopted by the river and harbor act of June 13, 1902, contemplated the completion of the original plan by the removal of the remainder of Sheepshead reef and Start rock, at an estimated cost of $17,000. This work was completed September 25, 1903, at a total cost of $8,546.68.

The river and harbor act of March 3, 1905, directed an examination to be made of Long rock, with a view to its removal, and authorized the expenditure of any balance remaining from previous appropriations for this purpose. The removal of such part of the rock to 6 feet below mean low water as the available funds ($8,453.32) would permit was authorized by the Secretary of War August 21, 1906. Of this amount $8,412.92 was expended to June 30, 1908, leaving a balance of $40.40 in addition to the amount appropriated March 2, 1907. As a result of this expenditure there is now a channel at Beauford Point 6 feet deep at mean low water and 100 feet wide.

The present project, adopted March 2, 1907, provides for completing the removal of Long rock, at a total estimated cost of $10,000.

The available funds are to be expended in completing the removal of Long rock and in maintenance.

The maximum draft that could be carried to Beauford Point on June 30, 1908, is estimated at 6 feet at mean low water. The general harbor anchorage ranges from 9 to 18 feet at mean low water. The mean range of tide is about 7¼ feet. The head of navigation is at a dock about 1,500 feet above Beauford Point. The harbor is about one-fourth mile wide and one-third mile long. The total length of navigable channel extending beyond the deep water of the harbor is about one-fifth of a mile.

The tonnage and value of the commerce of this harbor, mainly in coal, building materials, and manufactured goods, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1902	99,000	$500,000	1905	193,650	$2,071,800
1903	129,400	1,434,000	1906	270,460	2,789,208
1904	151,200	1,647,500	1907	269,135	2,545,585

The commerce of this harbor has increased with the improvement.

This improvement has made it easier to charter vessels for freight to this locality; but otherwise seems to have not reduced freight rates.

For detailed description of work see Report of the Chief of Engineers for 1900, page 1429. A sketch of the locality is printed in Report of the Chief of Engineers for 1903, page 862.

Report on examination for removal of Long rock is printed in House Document No. 182, Fifty-ninth Congress, second session.

July 1, 1907, balance unexpended	$12,675.46
June 30, 1908, amount expended during fiscal year for works of improvement	635.06
July 1, 1908, balance unexpended	12,040.40
July 1, 1908, outstanding liabilities	18.45
July 1, 1908, balance available	12,021.95

(See Appendix E 4.)

5. Bronx River and East Chester Creek, New York.—(*a*) *Bronx River.*—This stream empties into the East River north of Hunts Point. The navigable part extends from its mouth to West Farms, a distance of 3 miles. At this point it is crossed by a dam. The natural depth at the mouth was 4 feet at mean low water, and decreased ascending the stream to less than 1 foot at the head of navigation.

The project for improvement, adopted by the act of June 3, 1896, provides for making a channel 4 feet deep at mean low water and 100 feet wide from the entrance to Barlow street; thence to Dongan street 60 feet wide, and thence to the head of navigation 50 feet wide, the work to be done by dredging and rock removal. Estimated cost, $85,985.

Up to June 30, 1908, $37,952.02 had been expended on the project, all for improvement. There was received from sales of maps $0.65.

About 40 per cent of the work proposed under the present project has been completed and has resulted in a channel with depths of from 3 to 6 feet at mean low water and with a diminishing width of from 100 to 50 feet, except where reduced by ledges of rock, from the mouth to the turn east of the gas works. Above this point the channel remains as previously reported. The dredged channel has probably deteriorated somewhat.

The available funds and additional appropriation recommended are to be applied to continuing the improvement and to maintenance.

The maximum draft that could be carried June 30, 1908, over the shoalest part of the channel at mean low water from the mouth to the turn east of the gas works is estimated at about 3 feet; above this point, 1 foot. Mean range of tide is 6.6 feet at mouth and 6 feet at West Farms. The head of navigation is at a dam just beyond the dye works. The total length of navigable channel is about 3 miles.

The tonnage and value of the commerce of this river, mainly in coal, cotton goods, drugs for dyeing purposes, ice, and building materials, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1897	139,810	$526,025	1904	42,286	$196,642
1899	171,300	1,985,700	1905	181,093	820,482
1902	158,137	500,000	1906	341,538	1,720,097
1903	77,710	536,400	1907	382,957	1,807,317

The reduction of freight rates by this improvement is doubtful, but transportation has been facilitated.

Details of improvement can be found in Report of the Chief of Engineers for 1900, page 1389. A sketch of a part of the stream is printed in Report of the Chief of Engineers for 1904, page 1016.

July 1, 1907, balance unexpended	$43,624.16
Receipts from sales	.65
	43,624.81
June 30, 1908, amount expended during fiscal year for works of improvement	2,076.18
July 1, 1908, balance unexpended	41,548.63
July 1, 1908, outstanding liabilities	154.73
July 1, 1908, balance available	41,393.90
Amount (estimated) required for completion of existing project	6,485.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *East Chester Creek.*—This is a small tidal stream emptying into East Chester Bay. It was originally navigable at high tide for vessels drawing 7 feet as far as Lockwoods, a distance of 2¼ miles.

The project for improvement, adopted March 3, 1873, provided for a channel 100 feet wide and 9 feet deep, mean high water, from deep water in East Chester Bay to a point 3,000 feet above Lockwoods. Estimated cost, $136,500; subsequently reduced to $124,000, as modified in 1891.

Up to June 30, 1908, $115,500 had been expended on the project; of this amount $25,408.78 was for maintenance.

The project has been completed and has resulted in a channel 9 feet deep at mean high water and about 100 feet wide from East Chester Bay to a point 3,000 feet above Lockwoods. The channel above Lockwoods had deteriorated to a considerable extent, and the expenditures in the past fiscal year, therefore, resulted in restoring only about 75 feet in width in this section of the creek to its projected depth. Some shoaling has occurred in the channel below Lockwoods.

The appropriation recommended is to be applied to maintenance.

The maximum draft that could be carried over the shoalest part of the channel on June 30, 1908, is estimated at 9 feet at mean high water. Mean range of tides is 7.1 feet. The head of navigation is at the upper end of the artificial channel. The total length of navigable channel is about 2¾ miles.

The tonnage and value of the commerce of this creek, mainly in coal, building material, and miscellaneous freight, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1895	94,928	$2,199,186	1904	146,955	$963,263
1899	286,428	1,957,224	1905	206,275	1,755,850
1902	99,750	870,500	1906	282,655	3,063,360
1903	104,655	572,800	1907	354,019	1,954,254

The effect of this improvement has been to increase the number of firms carrying on business along this stream. So far as has been learned this improvement has made no change in freight rates, but commerce has greatly increased.

[a] See consolidated money statement on page 129.

For detailed reports see Reports of the Chief of Engineers for 1897, page 1089, and 1904, page 1016. A sketch of the stream is printed in Report of the Chief of Engineers for 1904, page 1016. For references to reports on examinations and surveys, see Report of the Chief of Engineers for 1904, pages 112 and 1061.

July 1, 1907, balance unexpended	$8,426.98
June 30, 1908, amount expended during fiscal year for maintenance of improvement	8,426.98
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

CONSOLIDATED.

July 1, 1907, balance unexpended		$52,051.14
Receipts from sales		.65
		52,051.79
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$2,076.18	
For maintenance of improvement	8,426.98	
		10,503.16
July 1, 1908, balance unexpended		41,548.63
July 1, 1908, outstanding liabilities		154.73
July 1, 1908, balance available		41,393.90
Amount (estimated) required for completion of existing project		6,485.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		16,485.00

(See Appendix E 5.)

6. Harbors at Port Jefferson, Mattituck, Huntington, Glencove, Flushing Bay, Canarsie Bay, and Sag Harbor, N. Y.—(a) Port Jefferson Harbor.—This is a large and deep inland bay, situated on the north shore of Long Island, and connected with Long Island Sound by a narrow entrance.

Before improvement the channel depth outside the entrance was but 4 feet at mean low water, whereas the depth in the harbor was 12 feet and more, at low tide, up to within 300 feet of the wharves of Port Jefferson village.

The first project for improvement was adopted in 1871, and completed in 1883, at a total cost of $79,000. Two jetties were built to shelter the inlet channel, one east of the inlet, 1,390 feet long, and one west, 940 feet long, both of scant cross section. A channel 8 feet deep at mean low water and 100 feet wide was dredged through the inlet and shoal outside.

The existing project for improvement, adopted September 19, 1890, and modified August 18, 1894, provides for dredging a channel through the harbor entrance 12 feet deep and 200 feet wide, to be protected by extending and enlarging the previously built jetties. Estimated cost, $145,000.

a See consolidated money statement on this page.

Up to June 30, 1908, $84,347.57 had been expended on the present project; of this amount $5,929.64 was for maintenance. The sum of $2,900 of the original allotment from the appropriation of March 2, 1907, was transferred to the allotment for improving harbor at Sag Harbor, N. Y.

About 57 per cent of the work proposed under the present project has been completed, and has resulted in securing a channel 12 feet deep at mean low water, and 200 feet wide, and in completing the east jetty to its full projected section for a distance of 1,470 feet, except at the shore end, where it is covered by sand. The west jetty is 940 feet long, with scant cross section. No work has been done on this jetty under the present project. It is reported that some shoaling has occurred in the dredged channel.

The available funds and additional appropriation recommended are to be applied to continuing the improvement and to maintenance.

The maximum draft that could be carried over the shoalest part of the channel June 30, 1907, is estimated at less than 12 feet at mean low water. Mean range of tides at entrance, 7 feet; at Port Jefferson wharves, 6.2 feet. The total length of navigable channel from Long Island Sound to Port Jefferson wharves is about 2½ miles. The harbor is about 2 miles long and three-fourths of a mile wide.

The tonnage and value of the commerce of this harbor, mainly in coal, building materials, farm produce, fish, and general merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1898	24,940	$360,200	1905	19,650(?)	$565,700(?)
1899	42,130	2,145,940	1906	118,705	2,544,900
1903	46,670	776,000	1907	95,455	1,066,665
1901	8,832(?)	90,424(?)			

This work has been without effect on freight rates.

For detailed report see Report of the Chief of Engineers for 1900, page 1393. A sketch of Port Jefferson Harbor is printed in Report of the Chief of Engineers for 1900, page 866.

July 1, 1907, balance unexpended		$24,021.20
Transferred to Sag Harbor	$3,500.00	
Transferred from Sag Harbor	600.00	
		2,900.00
		21,121.20
June 30, 1908, amount expended during fiscal year, for works of improvement		5,912.42
July 1, 1908, balance unexpended		15,208.78
July 1, 1908, outstanding liabilities		4,821.84
July 1, 1908, balance available		10,386.94
July 1, 1908, amount covered by uncompleted contracts		6,800.84
Amount (estimated) required for completion of existing project		51,373.29
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

[a] See consolidated money statement on page 137.

(*b*) *Mattituck Harbor.*—This harbor is a tidal inlet extending in a southerly direction from Long Island Sound to the village of Mattituck, Long Island. One mile above the mouth a tide milldam with gates has been built across the stream. The depth at the entrance, which is obstructed by a shifting sand bar, is from 1 to 2 feet; thence up to the milldam from 2 to 7 feet at low tide, and above the latter the depth is 6 feet at high tide.

The project adopted by the act of June 3, 1896, provides for a channel 7 feet deep at mean low water from the entrance to the dam and 7 feet deep at mean high water above the dam to the village, the width to be 80 feet, except near the mouth, where it is increased to 100 feet; the entrance channel to be protected by two parallel jetties, 400 feet apart, extending out to the 9-foot curve. Estimated cost, $83,000.

Up to June 30, 1908, $35,688.47 had been expended on the project; of this amount $143 was for maintenance. There was received from sales of maps $2.85.

About 43 per cent of the work proposed under the project has been completed, resulting in the completion of the west jetty to full projected section for a length of 680 feet, extending out to the 10-foot curve; the east jetty to full projected section for a length of 775 feet, extending out to the 7-foot curve; and in dredging a channel at the entrance 7 feet deep at mean low water, 60 feet wide, and about 800 feet long. The jetties serve to some extent in fixing the channel entrance, but navigation will not be materially benefited until the channel has been deepened by dredging.

The project contemplates dredging below and above the milldam. As this dam, and a fixed bridge of which it forms a part, prevent any dredging plant from entering the upper reach of the river, it is recommended that any appropriation for this improvement be made available only after local authorities have replaced the dam and bridge by a bridge with drawspans.

The available funds and additional appropriation recommended are to be expended in continuing the improvement and in maintenance.

The maximum draft that could be carried June 30, 1908, over the shoalest part of the channel at mean low water is estimated at about 1 foot. The head of navigation is at the village of Mattituck. The total length of navigable channel from Long Island Sound to Mattituck is about 2¼ miles. The range of tide outside the entrance is 4.8 feet and below the milldam before dredging in the entrance 2.2 feet.

The commerce consists principally of coal, building materials, fruits, farm produce, and general merchandise, and was reported in 1904 as amounting to 56,602 tons, valued at $2,041,766. During September and October, 1907, there were 44 arrivals and departures, carrying a total of 5,010 bushels of potatoes and 50 passengers.

No change in freight rates has yet resulted, the work not being sufficiently advanced.

For detailed description of this work see Annual Reports of the Chief of Engineers for 1891, page 843, and 1897, page 1095.

July 1, 1907, balance unexpended		$46,470.27
Receipts from sales		2.85
		46,473.12
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$7,015.74	
For maintenance of improvement	143.00	
		7,158.74
July 1, 1908, balance unexpended		39,314.38
July 1, 1908, outstanding liabilities		910.35
July 1, 1908, balance available		38,404.03
July 1, 1908, amount covered by uncompleted contracts		35,175.67
Amount (estimated) required for completion of existing project		8,143.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		(*)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(*c*) *Huntington Harbor.*—This harbor is a narrow tidal estuary extending inland from Huntington Bay, Long Island, in a southerly direction for a distance of about 2 miles.

Before improvement it had a natural available depth of nearly 8 feet, mean low water, for a stretch of 1¼ miles from the entrance southward, thence gradually decreasing to zero toward the head of the harbor.

In 1872 the first project was adopted, under which in 1873 a shoal at the harbor entrance was removed and a channel 2,200 feet long, 130 to 150 feet wide, and 8 feet deep at mean low water was dredged up to the town landings at a total cost of $22,500. In 1884 this channel had completely filled up.

The present project, adopted September 19, 1890, provides for dredging and maintaining a channel 8 feet deep at mean low water and 100 feet wide up to the upper wharves, to be protected by piling, if necessary. Estimated cost, $32,000.

Up to June 30, 1908, $38,000 had been expended on this project; of this amount $8,510.94 was for maintenance.

The present project is completed, except as to the dredging or pile construction necessary to maintain the channel. For purposes of maintenance the channel has been dredged 200 feet wide in lieu of pile protection. The channel has deteriorated somewhat.

The appropriation recommended is to be applied to maintenance.

The maximum draft that could be carried June 30, 1908, over the shoalest part of the channel is estimated at about 8 feet at mean low water. Mean range of tide, 7.2 feet. The head of navigation is at a causeway about one-third of a mile above Town dock. The total length of navigable channel from Huntington Bay to the causeway is about 2 miles.

The tonnage and value of the commerce of this harbor, mainly in coal, farm produce, building material, and miscellaneous merchandise, as obtained from the best available information, are as follows:

* See consolidated money statement on page 137.

Year.	Tons.	Value.	Year.	Tons.	Value.
1897	23,564	$473,109	1903	66,000	$1,086,000
1899	46,500	605,000	1904	94,950	2,818,250
1900	45,600	768,000	1906	105,212	2,774,850
1901	52,000	875,800	1907	96,196	1,901,061

This work has not affected freight rates.

For detailed description see Report of the Chief of Engineers for 1897, page 1100. A sketch of the upper part of the harbor is printed in the Annual Report for 1904, page 1023.

July 1, 1907, balance unexpended	$3,478.40
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,478.40
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*d*) *Glencove Harbor.*—This harbor is a small tidal inlet on the east side of Hempstead Harbor, Long Island. Its channel is about 2 feet deep at mean low water and a bar at the entrance has a foot less of depth. Before improvement vessels waiting for tides to enter the harbor were exposed to storms from the north and northwest.

The existing project, adopted August 11, 1888, and revised June 22, 1895, provides for the construction of a breakwater in Hempstead Harbor extending from the northwest corner of Glencove dock west-southwesterly toward Motts Point, so as to shelter the anchorage outside of Glencove Harbor. The breakwater is to have a length of 2,000 feet and to be built to a height of 3 feet above high water, with a top width of 5 feet. Estimated cost, $135,000.

Up to June 30, 1908, $72,000 had been expended on the project, all for improvement.

About 53 per cent of the work contemplated under the project has been completed and has resulted in building 1,564 feet of the breakwater to full projected section.

The present length of breakwater appears to afford sufficient protection to vessels seeking shelter from storms in this vicinity, and its further extension therefore seems to be unnecessary.

The maximum depth in the anchorage behind the breakwater is estimated at 21 feet at mean low water. Mean range of tides, 7.7 feet. The head of navigation is at the southern extremity of Hempstead Harbor, about 3½ miles from the breakwater.

The commerce of the harbor is chiefly coal, and amounted to 8,549 tons, valued at $40,515, in 1904, and to 7,062 tons, valued at $18,000, in 1906.

This improvement has no immediate effect on freight rates.

For details of improvement see Report of the Chief of Engineers for 1897, page 1103. A map is printed in Report of the Chief of Engineers for 1889, page 728.

Amount (estimated) required for completion of existing project ... $63,000.00

[a] See consolidated money statement on page 137.

(*e*) *Flushing Bay.*—Flushing Bay is on the north shore of Long Island, about 14 miles by water from the Battery, New York City. The bay is about 1 mile wide and 2 miles long, the depth in the original channel being not much greater than elsewhere in the bay. Before improvement the controlling depth up to Flushing was 3.9 feet at mean low water.

The existing project, adopted March 3, 1879, and modified September 19, 1888, and June 9, 1891, provides for building a dike 4,663 feet long on the west side of the channel to protect it from filling and for making and maintaining a channel 6 feet deep at mean low water up to the lower bridge at Flushing. Estimated cost, $173,500.

Up to June 30, 1908, $159,190.32 had been expended on the project. During progress of work it was repeatedly necessary to redredge some parts of the channel, so that it is not possible to state exactly what part of above sum was used for maintenance. The expenditure to June 30, 1908, for maintenance is estimated at $12,700.

The project has been completed except as to removing a small shoal below Broadway Bridge, and to making such slight changes in the outer end of the dike as to make it less of an obstruction to navigation. There is now a channel having a least depth of 6 feet at mean low water, and 200 feet wide up to Broadway Bridge, except as to the above-mentioned shoals. Thence to Main Street Bridge the channel is 100 feet wide and not less than 6 feet deep at mean low water. The whole of the dike is in bad condition, and all of the outer end, 1,606 feet long, with the exception of a few scattering piles and stones, has been carried away by storms and ice. Dike construction was discontinued in 1891.

The available funds are to be applied to making such slight changes in the dike as may be necessary to make it less of an obstruction to navigation, and to completing the improvement, and the additional appropriation recommended is to be applied to maintenance.

The maximum draft that could be carried June 30, 1908, from East River to just beyond the Main Street Railroad Bridge at mean low water is estimated at 6 feet. Mean range of tides, 7.1 feet. The head of navigation is 1 mile above Strong's causeway. The total length of the navigable channel is about 5½ miles.

The tonnage and value of the commerce of Flushing Bay, mainly in coal, building materials, dyewoods, and miscellaneous merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1897	163,395	$1,449,438	1904	142,996	$2,599,488
1899	158,755	1,534,937	1905	142,274	2,656,650
1901	200,473	4,196,406	1906	278,312	3,937,441
1902	186,000	1,613,100	1907	232,911	2,537,825
1903	110,100	960,750			

This work has facilitated transportation, but no appreciable effect on freight rates has been ascertained.

For detailed description of improvement, see Report of the Chief of Engineers for 1897, page 1106. A map is printed in the Report of the Chief of Engineers for 1903, page 868.

July 1, 1907, balance unexpended		$28,537.84
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$23,490.32	
For maintenance of improvement	2,237.84	
		25,728.16
July 1, 1908, balance unexpended		2,809.68
July 1, 1908, outstanding liabilities		364.24
July 1, 1908, balance available		2,445.44
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(*f*) *Canarsie Bay.*—This bay forms the northwest part of Jamaica Bay at Canarsie Landing. The original depth from the landing to Big channel was 4.2 feet and to Island channel 1.3 feet at mean low water.

The project for this improvement, adopted June 14, 1880, and subsequently enlarged in 1889 and 1896, provides for the construction of two dikes and dredging between them where necessary to secure a channel 100 to 150 feet wide and 6 feet deep, connecting the steamboat dock at Canarsie with Big channel, Jamaica Bay; also for a channel 4 feet deep and about 50 feet wide, running in a southwesterly direction from Canarsie Landing to Island channel, and for a channel 5 feet deep and 50 feet wide, running in a northeasterly direction to Gophel channel. Estimated cost, $88,000.

Up to June 30, 1908, $72,716.16 had been expended on the project; of this amount, $2,843.80 was for maintenance. There was $750 of the original allotment from the appropriation of March 2, 1907, transferred to the allotment for improving harbor at Sag Harbor, N. Y.

The work of improvement under the project has been completed. The dredged channels have deteriorated somewhat, and the dikes are in poor condition.

The available funds are to be applied to maintenance.

The maximum draft that could be carried June 30, 1908, over the shoalest part of the channel at mean low water is estimated at 6 feet in the main channel, 2½ feet in the West Branch, and 3 feet in the East Branch. Mean range of tides, 4.7 feet. The total length of navigable channel is about 1 mile. The head of navigation is at Canarsie Landing.

The tonnage and value of the commerce of this improvement, mainly in building materials, fertilizers, fish, and coal, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
[illegible]	50,000	$427,375	1905	95,460	$1,714,022
1901	450,000	2,000,000	1907	127,516	413,784
1904	124,594	1,861,008			

[a] See consolidated money statement on page 137.

The commerce in Jamaica Bay was greatly benefited by this improvement. Transportation has been developed, but no reduction of freight rates has been ascertained.

Pending action by Congress upon a plan for improvement of Jamaica Bay, to be submitted in compliance with river and harbor act of March 2, 1907, it is recommended that no appropriation be made for improvement or maintenance of the channel of Canarsie Bay, which bay opens into Jamaica Bay.

Details as to this improvement may be found in Report of the Chief of Engineers for 1897, page 1114. A sketch of Canarsie Bay is printed in Report of the Chief of Engineers for 1904, page 1026.

July 1, 1907, balance unexpended	$3,934.28
Transferred to Sag Harbor	750.00
	3,184.28
June 30, 1908, amount expended during fiscal year for maintenance of improvement	150.44
July 1, 1908, balance unexpended	3,033.84

(*g*) *Sag Harbor.*—This harbor lies on the northern shore of Long Island, about 24 miles west of Montauk Point. It is a small bay, sheltered by Long Island on the south and west, and partly by Shelter Island on the north, and is open to the northeasterly storms.

The project adopted June 13, 1902, consists in constructing a breakwater 3,180 feet long from Conklin Point, at an estimated cost of $71,000.

The breakwater has been completed; the total expenditure on the project up to June 30, 1908, amounts to $61,946, all for improvement. There was received $2,296 on the bond of a failing contractor, and a transfer of funds from allotments under the appropriation of March 2, 1907, was made as follows: From the allotment for improving harbor at Mattituck, N. Y., $2,900; from the allotment for improving harbor at Canarsie Bay, $750.

The maximum draft that can be carried, June 30, 1908, through the harbor up to the wharves is about 12 feet at mean low water. The mean range of tide is 2.5 feet. The head of navigation is located in Sag Harbor Cove, about 1 mile above the town wharves. The total length of navigable channel from these wharves to the deep water of Gardiners Bay is about 5 miles. The breakwater affords protection to an area approximately one-half mile long by three-eighths of a mile wide.

The tonnage and value of the commerce of this harbor, mainly in general merchandise, fruits, and farm produce, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1904	8,454	$187,015	1906	19,041	$287,275
1905	18,771	401,989	1907	41,142	960,950

While the breakwater will afford shelter for vessels, it is not expected to affect freight rates.

For detailed report see Report of the Chief of Engineers for 1900, page 1451. A sketch of the harbor is printed in the Report of the Chief of Engineers for 1903, page 870.

July 1, 1907, balance unexpended		$26,907.19
Transferred from Port Jefferson and Canarsie Bay	$4,250.00	
Transferred to Port Jefferson	600.00	
		3,650.00
		30,557.19
June 30, 1908, amount expended during fiscal year for works of improvement		30,557.19

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July 1, 1907, balance unexpended		$133,349.18
Received from sales		2.85
		133,352.03
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$66,975.67	
For maintenance of improvement	6,009.68	
		72,985.35
July 1, 1908, balance unexpended		60,366.68
July 1, 1908, outstanding liabilities		6,096.43
July 1, 1908, balance available		54,270.25
July 1, 1908, amount covered by uncompleted contracts		41,976.51
Amount (estimated) required for completion of existing project		146,716.29
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance in addition to the balance unexpended July 1, 1908		31,143.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix E 6.)

7. *East River and Hell Gate, New York.*—East River, a tidal strait separating New York City from Long Island, extends from the Battery to Throgs Neck, a distance of about 16 miles. In its original condition it was obstructed by rocks and reefs, especially in the part known as Hell Gate.

The improvement of this waterway was commenced in 1852, under a project prepared in 1848, which contemplated the removal of rocks at Hell Gate and Diamond reef. The amount expended under this project was $33,861.59.

The existing project for improvement, adopted in 1868 and modified in 1870, 1874, 1884, 1889, 1891, and 1899, provides for the removal of rocky obstructions from the channel between the Battery and Baretto Point to depths varying from 18 to 26 feet, and for the construction of sea walls and dikes where necessary to guide the tidal currents. The cost of the work was estimated at $5,639,120. This is the estimated cost for removal of reefs and rocks only at Hell Gate, Diamond and Coenties reefs, and Man-o'-War rock. But from time to time other obstructions have been removed with the approval of higher authority, though no addition has been made to the estimated cost of the project. The locations of these obstructions are reported below. To these works should be added the construction of a crib between Great and Little Mill rocks, and the dredging of channels connecting the main channel with the posts of Davids Island and Fort Totten. The cost of this extra work, extending over a period of twenty-seven years, is $575,416. The amount required to complete the project is therefore increased in this report

by that amount, less $335,466, not required under the estimate for removing Man-o'-War rock, or a net increase of $239,950.

Up to June 30, 1908, $4,800,214.76 had been expended; of this amount $4,224,700.74 had been expended on the present project for improvement; $98.02 was for maintenance, and the balance, $575,416, on the works above enumerated not included in the original project. There was received from sales of condemned property $1,335.75.

About 75 per cent of the work proposed under the present project has been completed and has resulted in the removal to the contemplated depths of Diamond reef off Governors Island; Coenties reef, off Coenties slip; Third street reef; Pilgrim rock, off Twentieth street; Charlotte rock, off Hunters Point; Man-o'-War rock; off Thirty-ninth street; Hallets Point, Ways reef, Shell Drake, and Scaly rock, in Hell Gate; North Brother Island reef; reef off Barretto Point; and in the partial removal of the following:

Localities.	Least original depth.	Least present depth.	Least proposed depth.
	Feet.	*Feet.*	*Feet.*
Battery reef	12.8	12.8 to 26+	26
Reef off South Ferry slips	17.0	19 to 26+	26
Shell reef off Tenth to Nineteenth streets	7.5	18	18
Ferry reef off Thirty-fourth street	7	24	26
Middle reef (including Flood Rock, Gridiron, Hen and Chickens, and Negro Heads)	+ 6	18.3	26
Frying Pan reef	11	18	26
Pot rock	20	22.8	26
Heel Tap	12.1	20.5	26

The available funds and additional appropriation recommended are to be applied to making a resurvey of such part of the present project as may be necessary, including any ledge or ledges of rock near to the westerly shore, in completing the removal of Pot rock, and Frying Pan reef, nearly all of Middle reef, and in removing parts of obstructions above enumerated as not completed.

The maximum draft that could be carried at mean low water June 30, 1907, through the main channel from the Battery to Long Island Sound is estimated at 26 feet. The length of this waterway is about 16 miles. The range of tide south of Hell Gate is from 4½ to 5 feet, and east of it from 5 to 7 feet.

The traffic in East River is very great, and is intimately connected with that of New York Harbor proper. It is impracticable to show what proportion belongs to East River, especially as the heaviest coastwise traffic is carried on in vessels which do not enter or clear at the custom-house.

The improvement of the river has been of great benefit to navigation, but since most of the freight carried by the vessels using it is not local its effect on freight rates can not be determined.

Attention is invited to the report of the district engineer relative to the desirability of removing obstructions in the channel between South Brother Island and Lawrence Point and of increasing the present depth of about 18 feet over Middle Ground to 26 feet; and to providing a channel of 26 feet between North and South Brother islands. An estimate of the cost of the latter accompanies his report on an examination and survey authorized by the river and harbor act of March 2, 1907, which will be duly submitted. These suggested improvements are deemed worthy of consideration.

Detailed description of this improvement is printed in the Reports of the Chief of Engineers for 1868, page 741; for 1874, Part 2, page 164, and for 1897, page 1026.

July 1, 1907, balance unexpended	$402,881.10
Receipts from sales	1.50
	402,882.60
June 30, 1908, amount expended during fiscal year for works of improvement	18,420.16
July 1, 1908, balance unexpended	384,462.44
July 1, 1908, outstanding liabilities	414.83
July 1, 1908, balance available	384,047.61
July 1, 1908, amount covered by uncompleted contracts	229,856.92
Amount (estimated) required for completion of existing project	1,031,292.57
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	300,000.00

(See Appendix E 7.)

8. Harlem River, New York.—The Harlem River and Spuyten Duyvil Creek, both included in the improvement, are two waterways of a joint length of about 8 miles which join at Kingsbridge, N. Y., and separate Manhattan Island from the mainland. The narrow channel at their junction was obstructed by a ledge of rocks awash at low tide.

Before improvement the Harlem River had an available depth of 10 feet at mean low water from the East River to Morris dock, except at Highbridge, where it was only 6 feet deep. From Morris dock to Fordham Landing there was a crooked channel 7 feet deep, and above the latter place the river could be used only by the smallest class of vessels. Spuyten Duyvil Creek, from Kingsbridge to the Hudson, had a depth of 4 feet.

The original project for improvement, adopted in 1874, provided for the removal of old bridge piers, Candle Factory reef, and bowlders at various places near the East River to a depth of 12 feet, the cost of the work being estimated at $167,875.56. In furtherance of this project $21,000 was expended.

The existing project, adopted June 18, 1878, and modified October 7, 1886, provides for a continuous channel 400 feet wide and 15 feet deep from the East River to the Hudson River, except about 1,300 feet north of Highbridge, where the width was made 354 feet, and at the rock cut through Dyckmans Meadow, where the width was reduced to 350 feet and the depth increased to 18 feet. Estimated cost, $2,700,000.

On June 30, 1908, $1,446,543.13 had been expended on the present project, all for improvement. There was received on account of reimbursements $41.17, and from the sale of maps $1.60. About 53 per cent of the work proposed under the present project has been completed, and there is now a channel from Hell Gate to Macombs Dam Bridge 15 feet deep at mean low water and 100 to 400 feet wide, except in the vicinity of some of the bridges where more or less shoaling has occurred. From Macombs Dam Bridge to the Hudson River

a channel 15 feet deep at mean low water and 150 feet wide has been dredged, but it is probable this channel has been narrowed somewhat by the filling in of material from the sides. The rock cut through Dyckmans Meadow has been completed.

The available funds and additional appropriation recommended are to be applied to continuing the improvement at and east of Macombs Dam Bridge.

The maximum draft that could be carried June 30, 1908, through the channel from East River to Hudson River at mean low water is estimated at 15 feet. The range of tides in Harlem River as determined in 1907 is as follows: At Mill Rock, 5 feet; Willis Avenue Bridge, 5.1 feet; Macombs Dam Bridge, 4.7 feet; Broadway Bridge, 3.8 feet; Spuyten Duyvil Bridge, 3.7 feet. The total length of water way is about 8 miles.

The tonnage and value of the commerce of this river, which is general in character, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1895	7,533,594	$203,707,376	1905	9,998,021	$270,210,309
1903	6,910,386	282,186,100	1906	11,385,649	(?) 104,359,757
1904	9,130,763	231,384,004	1907	[a]12,385,507	313,380,743

[a] Of this 4,843,450 tons are handled by the New York, New Haven and Hartford Railroad Company over the most easterly 1 1/16 miles of the Harlem River.

The principal benefit derived from the improvement has been in the way of increased facilities for handling shipments, which make a material saving in the cost of transportation.

Detailed description of this improvement is printed in Reports of the Chief of Engineers for 1887, page 665, and 1897, page 1019.

July 1, 1907, balance unexpended	$147,455.74
Receipts from sales and reimbursements	42.77
	147,498.51
June 30, 1908, amount expended during fiscal year for works of improvement	48,998.87
July 1, 1908, balance unexpended	98,499.64
July 1, 1908, outstanding liabilities	1,245.99
July 1, 1908, balance available	97,253.65
Amount (estimated) required for completion of existing project	1,155,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	300,000.00

(See Appendix E 8.)

9. Newtown Creek, New York.—This creek, an inlet of the East River, extending inland between Kings and Queens counties, N. Y., for a distance of about 4 miles, had a natural depth varying from 12½ feet at the mouth to 4 feet at the head of navigation.

The original project, adopted in 1880 and modified in 1884, provided for a channel 240 feet wide and 21 feet deep from the mouth to the Vernon Avenue Bridge; thence to the head of navigation on both

branches or channels decreasing from 175 to 100 feet in width and from 18 to 10 feet in depth. The cost of the work was estimated at $255,500. In carrying out this project $197,500 was expended.

The existing project, adopted June 3, 1896, is to secure a uniform channel, 125 feet wide and 18 feet deep, from the East River to the head of navigation at Metropolitan avenue, at an estimated cost of $450,000. This estimate was subsequently reduced to $213,000.

Up to June 30, 1908, $218,571.46 had been expended on the project. Of this amount $19,962 was for maintenance.

About 93 per cent of the work proposed under the present project has been completed, resulting in a channel of the projected width and depth, with the exception of some widening at the entrance and the removal of bowlders near the mouth of the creek. The dredged channel has deteriorated to a considerable extent.

The available funds and additional appropriation recommended are to be applied to completing the improvement and to maintenance.

The maximum draft that could be carried over the shoalest part of the channel June 30, 1908, at mean low water, is estimated at 17 feet. The mean range of tides is about 4½ feet. The total length of navigable channels is about 4 miles. The head of navigation in both branches is at the Metropolitan Avenue bridges.

The tonnage and value of the commerce of this creek, mainly in coal, building materials, oil, and general merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1903	2,675,025	$90,535,640	1906	2,803,380	$214,711,751
1904	3,771,726	108,313,377	1907	3,108,374	175,222,346
1905	3,428,404	130,812,974			

The increased depth resulting from this improvement has greatly benefited commerce.

Freight rates have been reported as greatly reduced by this improvement. It is difficult if not impracticable to ascertain details; but the large and valuable commerce of this water is the best index to the effect of the improvement.

Detailed descriptions of this improvement are printed in the Reports of the Chief of Engineers for 1896, page 760, and 1900, page 1411. A sketch of the locality is printed in Report of the Chief of Engineers for 1904, page 1034.

July 1, 1907, balance unexpended	$20,034.21
June 30, 1908, amount expended during fiscal year for maintenance of improvement	205.67
July 1, 1908, balance unexpended	19,828.54
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix E 9.)

10. Browns Creek, New York.—This is a narrow stream which empties into Great South Bay, Long Island, near Browns Point. It

had originally a depth of from 1 to 3 feet at low water, a bar at the mouth having less than 1 foot.

The project for improvement, adopted September 19, 1890, provides for a channel 100 feet wide and 4 feet deep, to extend from deep water in the bay up to Sayville highway bridge, and to be protected at the entrance by jetties on both sides. Estimated cost, $46,000.

Up to June 30, 1908, $31,204.83 had been expended on the project, of which amount $6,204.83 was for maintenance.

About 54 per cent of the work proposed under the project has been completed, resulting in the building of two jetties at the entrance and in the dredging of a channel 100 feet wide and 4 feet deep at mean low water for a distance of 3,200 feet from the entrance. Because of shoaling this dredged channel was redredged in 1905 to 4 feet depth at mean low water for a distance of about 1,200 feet from the end of the jetties.

There is now an available channel about 100 feet wide and 3 to 4 feet deep at mean low water for a distance of 3,200 feet from the entrance. Above this the channel remains in its original condition.

The west jetty is 492 feet long and the east jetty 438 feet long, both with top width of 3 feet at 1 foot above high water, and both partly covered at the shore end by accretion. They are in bad condition.

The available funds and additional appropriation recommended are to be applied to maintenance.

The maximum draft that could be carried over the shoalest part of the dredged channel at mean low water June 30, 1908, is estimated at 3 feet; mean range of tides, 1 foot. The head of navigation is at the Sayville highway bridge, about 1½ miles from the mouth.

Because of rapid deterioration, due mainly to the inflow of mud from the marshes bounding the channel, $6,204.83 has already been expended in redredging, and the jetties, built only to about one-third of their projected lengths, are in a very bad condition.

The total cost of completing the project will be much greater than the original estimate, and if the channel, which is now only 3,200 feet long and requires redredging, is extended upstream, the expenditure for maintenance will increase proportionately.

Considering the limited number of vessels using this creek for transportation purposes, the cost of improving and maintaining the entire length of the creek to Sayville, and completing the breakwaters as projected, would be out of proportion to the benefits to be derived therefrom. It is therefore recommended that future appropriations be made, not for extending the improvement, but only for maintaining the present dredged channel.

The tonnage and value of the commerce of this creek, mainly in coal, building materials, and fish, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1898	10,700	$213,800	1904	24,000	$807,075
1899	11,642	251,350	1905	51,675	1,811,195
1901	17,025	454,500	1906	29,675	968,880
1902	17,630	299,300	1907	34,975	1,043,865
1903	20,880	609,450			

So far the improvement has resulted in providing a harbor for fishing boats, and has had no appreciable effect on freight rates.

Details in reference to this work appear in Reports of the Chief of Engineers for 1897, page 1111, and for 1900, page 1417. A sketch of the creek is printed in Report of the Chief of Engineers for 1894, page 710.

July 1, 1907, balance unexpended	$5,000.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	204.83
July 1, 1908, balance unexpended	4,795.17
Amount (estimated) required for completion of existing project	16,204.83
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	3,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix E 10.)

11. Great South Bay, New York.—The first project, adopted September 19, 1890, provided for the improvement of the Patchogue River, a small inlet extending from Great South Bay, Long Island, to the village of Patchogue. This stream had, before improvement, a depth of 2 feet. The project provided for a channel about 5,000 feet long, 60 feet wide, and 6 feet deep, to be protected at its mouth against westerly storms by a jetty 1,700 feet long. Estimated cost, $40,000. On June 30, 1902, there had been expended on this work $40,000, and the project was completed.

The present project, adopted June 13, 1902, provides for dredging a channel from Fire Island Inlet, which connects Great South Bay with the ocean, to Patchogue, on Patchogue River. From the inlet to the central basin in Great South Bay the channel is to be 10 feet deep at mean low water and 200 feet wide. From the central basin to Patchogue the channel is to be 8 feet deep and 100 feet wide at mean low water. Estimated cost, $66,000, and $2,000 annually for maintenance.

Up to June 30, 1908, $65,983.21 had been expended on the project, of which amount $6,162.39 was for maintenance. There was received from the sale of maps $1.45. About 91 per cent of the work contemplated under the present project has been completed, resulting in a channel 200 feet wide and 10 feet deep at mean low water in the bay, except at bars "A" and "B;" and in the completion of a channel 100 feet wide and 8 feet deep at mean low water in the river. Considerable shoaling has occurred in the latter.

The appropriation of March 2, 1907, and the additional appropriation recommended are to be applied to continuing the improvement, and to maintaining the Patchogue River channel. The work of improvement in Great South Bay was stopped by injunction December 12, 1903, and again November 8, 1906. The injunction finally having been dissolved, the contractor was notified February 19, 1908, to resume work but has failed to do so. The balance in hand from the

appropriation of March 3, 1905, has been reserved for continuing the improvement.

The maximum draft that could be carried June 30, 1908, over the shoalest part of the channel from Fire Island Inlet to central basin was 8.5 feet and in Patchogue River 5 feet.

Mean range of tides, 1 foot. The head of navigation in Patchogue River is at a fixed bridge at Division street, Patchogue. The total length of navigable channel from Fire Island Inlet to Patchogue is about 17½ miles and to Belleport 22 miles.

The tonnage and value of the commerce of this locality, mainly in coal, lumber, and fish, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1898	255,200	$3,702,000	1903	258,500	$3,995,000
1899	266,800	3,808,500	1904	257,879	4,037,130
1900	271,100	3,919,000	1905	224,526	3,871,850
1901	281,300	4,025,000	1906	232,500	4,014,000
1902	257,500	4,000,000	1907	224,108	3,903,723

The effect of the work has been rather to facilitate commerce than to reduce freight rates. No reduction in these has been ascertained.

For details as to improvement see Patchogue River, Reports of the Chief of Engineers for 1897, page 1108: for 1901, page 1249, and for 1903, page 134. A sketch is printed in Report of the Chief of Engineers for 1903, page 876.

July 1, 1907, balance unexpended	$4,352.92
Receipts from sales	1.45
	4,354.37
June 30, 1908, amount expended during fiscal year for maintenance of improvement	336.13
July 1, 1908, balance unexpended	4,018.24
July 1, 1908, outstanding liabilities	549.70
July 1, 1908, balance available	3,468.54
July 1, 1908, amount covered by uncompleted contracts	1,503.03
Amount (estimated) required for completion of existing project	2,162.39
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	4,000.00

(See Appendix E 11.)

12. Hudson River, New York.—The portion of this river which is now under improvement is the stretch beginning at the State dam at Troy and extending downstream to Coxsackie, a distance of 28 miles. In its natural condition the channel was narrow and crooked, with a navigable depth of 4 feet between the State dam and Albany, of 7½ feet between Albany and New Baltimore, of 11 feet between New Baltimore and Coxsackie, and of 12 feet or more below Coxsackie.

The original project for improvement, adopted in 1834, modified in 1852 and again in 1866, had for its object the securing of a navigable channel of sufficient width and 9 feet deep between Troy and

Albany, and 11 feet deep between Albany and New Baltimore. In carrying out this work $1,667,938 was expended.

The existing project, adopted July 13, 1892, and modified March 3, 1899, provides for a 12-foot channel 150 feet wide from the State dam to the foot of Jacob street, Troy; thence gradually increasing in width to 400 feet at the foot of Broadway, Troy; thence 400 feet wide to Coxsackie. This work was estimated to cost $4,343,863. The act of March 3, 1905, authorizes the expenditure, in the discretion of the Secretary of War, of $85,000 of the amount appropriated by that act for improving Hudson River, for the removal of Stonehouse bar, opposite New Baltimore. Twenty thousand seven hundred and one dollars and nine cents has been expended on this work. The same act authorized the expenditure of not exceeding $10,000 in providing a channel for access to the harbor of Tarrytown, all of which amount has been expended under this authority. The act of March 2, 1907, authorized the expenditure of $5,000 in removing the bar and deepening the channel at the mouth of Schodack Creek. Under this authority $4,432.37 was expended.

On June 30, 1908, $3,560,252.58 had been expended; of this amount $3,525,119.12 had been expended on the present project, of which $279,186.90 was for maintenance; and the balance, $35,133.46, on the works above enumerated not included in the project. There was received from sales of maps $52; from repayments $5.61; from reimbursements on account of removal of obstructions from the channel, $78.10.

About 75 per cent of the work proposed under the present project has been completed, resulting in a maximum depth at mean low water of a navigable channel with a width of not less than 100 feet, of 11 feet, from Coxsackie to the Delaware and Hudson Company's bridge at Troy, N. Y., except at the New York Central and Hudson River Railroad Company's freight bridge at Albany, where the channel through the draw spans is contracted to a maximum of 90 feet, and over the Bath cross-over, where there is only 10 feet depth for a width of 200 feet; a depth 10.5 feet and width of 100 feet from the Delaware and Hudson Company's bridge to within 900 feet of the sloop lock at the State dam, and 4.5 feet over the miter sill of the sloop lock.

The range of the tides in seasons of moderate rain varies from 2.55 feet at the State dam, 2.89 feet at Broadway, Troy, 2.84 feet at Albany, to 3.69 feet at Coxsackie, being an increase in elevation of high water of about 0.5 foot at Albany and at the foot of Broadway, Troy. The head of navigation for the tidal portion of the river is at the State dam, 153 miles from the Battery in New York City. The total length of navigable channel under improvement is 28 miles.

For results of previous tidal observations, reference is made to the Reports of the Chief of Engineers for 1897, page 998, and 1900, page 1490.

The commerce within the limits of the improvement, mainly in general merchandise, farm products, building material, fuel, and ice, amounted to 3,325,360 tons, valued at $75,664,748 in 1906, and to 2,881,168 tons, valued at $66,853,731 in 1907.

The effect of the improvement has probably been to reduce freight rates.

The available funds and additional appropriation recommended are to be applied to continuing the improvement and to maintenance.

July 1, 1907, balance unexpended		$303,243.69
Receipts from sales, reimbursements, and repayments		116.56
		303,360.25
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$98,484.01	
For maintenance of improvement	8,186.55	
		106,670.56
July 1, 1908, balance unexpended		196,689.69
July 1, 1908, outstanding liabilities		19,324.07
July 1, 1908, balance available		177,365.62
July 1, 1908, amount covered by uncompleted contracts		131,373.32
Amount (estimated) required for completion of existing project		901,376.80
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		470,000.00

(See Appendix E 12.)

13. Saugerties Harbor, New York.—Saugerties Harbor is the name applied to the mouth of Esopus Creek, which empties into the Hudson River from the west, about 100 miles above New York City, which creek is navigable at high water for a distance of about 6,000 feet from deep water in the Hudson River. Above the steamboat landing, which is a distance of about 4,500 feet from deep water, there is little traffic. The original depth over the bar was 3 feet at mean low water, which had been increased to 7 feet by dredging done by the State of New York in 1885-86.

The original project, which contemplated securing a permanent channel 7 feet deep at mean low water and 100 feet wide, at an estimated cost of $52,000, was adopted in 1884, modified in 1887, and completed in 1892, with an expenditure of $42,000. To June 30, 1902, $15,000 had been expended for maintenance.

The existing project, which contemplates a channel 12 feet deep at mean low water and 200 feet wide from the channel of the Hudson River to the steamboat landing, at an estimated cost of $44,685, with an annual expenditure of $2,500 for maintenance, was adopted June 13, 1902.

The river and harbor act of March 3, 1905, authorizes the Chief of Engineers, upon application, to permit the extension of the channel from the point at which the present project terminates up to a point 600 feet below the dam in Esopus Creek, provided the plan of improvement is first submitted to and approved by him and that no part of the appropriation made by said act shall be expended therefor.

Up to June 30, 1908, $31,859.23 had been expended on the present project; of this amount $19,064.99 was for maintenance. There was received from the sale of maps $1.10.

About 25 per cent of the work proposed under the present project has been completed, resulting in straightening the navigable channel of 12 feet depth where Barclays Point reef has been removed, and a fair channel from the mouth of the harbor to the steamboat landing.

The expenditure for maintenance is mainly due to restoring the channel above the reef, where, owing to the breaking of the dam a short distance above the head of navigation in the summer of 1902 and the consequent release of a large quantity of mud and silt retained by it, the channel had been reduced in width and depth so as to be practically closed to the navigation of large boats, and the relief to navigation along the wharves on the north side of the channel, where extensive shoaling had taken place, apparently as the result of the removal of the rock off Barclays Point.

The available funds, and additional appropriation recommended are to be applied to continuing the improvement, and to maintenance.

The maximum draft at mean low water that could be carried June 30, 1907, is estimated at 10 feet, for a minimum width of 50 feet. The mean rise and fall of tides is about 4 feet. The head of navigation is at a point about 1,600 feet below the dam. The total length of navigable channel is about 1¼ miles.

The tonnage and the value of the commerce of this harbor, mainly in building materials, manufactures, fuel, and general merchandise, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1901	67,473		1905	81,600	$1,598,000
1902	66,500		1906	83,300	1,606,200
1903	112,677		1907	95,400	1,873,000
1904	113,200	$18,882,195(?)			

The effect of the improvement, according to the best information available, is to reduce freight rates during the season of navigation.

Details in reference to this work appear in Reports of the Chief of Engineers for 1895, page 910, and 1900, page 1518. A sketch is printed in Report of the Chief of Engineers for 1904, page 1046.

July 1, 1907, balance unexpended	$20,440.61
Receipts from sales	1.10
	20,441.71
June 30, 1908, amount expended during fiscal year, for works of improvement	4,299.84
July 1, 1908, balance unexpended	16,141.87
July 1, 1908, outstanding liabilities	819.80
July 1, 1908, balance available	15,322.07
July 1, 1908, amount covered by uncompleted contracts	11,827.84
Amount (estimated) required for completion of existing project	15,749.99
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	20,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix E 13.)

14. Harbors at Rondout and Peekskill, N. Y.—(a) Rondout Harbor.—This harbor is at the mouth of Rondout Creek, which empties into the Hudson River on its west shore, 90 miles above New York

City. The creek, which is navigable to Eddyville, 3 miles from its mouth, was the most easterly section of the Delaware and Hudson Canal until that waterway was abandoned several years ago. The original depth before the improvement was begun, which was the result of work of private parties, was 7 feet at mean low water.

The original project, which contemplated securing a channel 14 feet deep at mean low water and 100 feet wide, at an estimated cost of $172,500, was adopted June 10, 1872, and was completed in 1880 at a total cost of $90,000. Since then the expenditure has been for maintenance.

Up to June 30, 1908, $132,461.27 had been expended on the project. Of this amount $42,461.27 was for maintenance since 1880.

The result of the above expenditure is a channel 13½ feet deep at mean low water and not less than 80 feet wide.

The available funds and additional appropriation recommended are to be applied to maintenance.

The maximum draft that could be carried through the channel June 30, 1908, was 13½ feet at mean low water, with a least width of channel of about 80 feet. The mean rise and fall of tides is 4 feet. The head of navigation is at Eddyville. The total length of navigable channel is 3 miles.

The effect of the improvement has probably been to keep the freight rates down during the season of navigation.

The tonnage and value of the commerce of this harbor, mainly in general merchandise, building materials, fuel, and ice, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1904	1,469,000	$41,065,000	1906	998,524	$5,640,900
1905	1,325,000	46,112,500	1907	1,255,000	5,025,000

Detailed description of this improvement is printed in Reports of the Chief of Engineers for 1880, page 494, and for 1895, page 913. A sketch of the harbor is printed in Report of the Chief of Engineers for 1903, page 1884.

July 1, 1907, balance unexpended	$12,123.42
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,284.69
July 1, 1908, balance unexpended	10,838.73
July 1, 1908, outstanding liabilities	2,169.51
July 1, 1908, balance available	8,669.22
July 1, 1908, amount covered by uncompleted contracts	4,750.41
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

a See consolidated money statement on page 150.

(*b*) *Peekskill Harbor.*—This harbor is an indentation on the eastern shore of the Hudson River, about 46 miles above New York City, and was a flat, about 3,500 feet wide, extending from the shore to the deep-water channel of the Hudson River, with a depth of water over it of about 5 feet at mean low water, except near the shore, where it was about 6 feet deep.

The original project for improvement, which provided for a dredged channel 10 feet deep at mean low water, and 100 feet wide from deep water in the Hudson River north of the village to deep water south of it, following generally the contour of the shore, at an estimated cost of $50,000, was adopted June 3, 1896, and was completed in 1899, at a cost of $19,400.

Up to June 30, 1908, $28,214.52 had been expended on the project; of this amount $8,814.52 was for maintenance.

The channel was restored to its projected depth and width in 1907. It is probable some shoaling has occurred since then.

The available balance and the additional appropriation recommended are to be applied to maintenance.

The maximum draft that could be carried through the channel June 30, 1908, at mean low water is probably less than 10 feet. Mean range of tides about 3 feet. The total length of channel is 1⅛ miles.

The tonnage and value of the commerce of this harbor, mainly in general merchandise, building material, and fuel, as obtained from the best available information, are as follows:

Year.	Tons.	Value.	Year.	Tons.	Value.
1904	81,285	$3,751,985	1906	88,500	$659,864
1905	74,546	1,134,748	1907	107,963	733,766

The effect of the improvement during the season of navigation is to lower freight rates.

Detailed description of this improvement is printed in Report of the Chief of Engineers for 1895, page 999, and for 1897, page 1016.

A sketch of the harbor is printed in Report of the Chief of Engineers for 1903, page 885.

July 1, 1907, balance unexpended	$3,312.28
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,026.80
July 1, 1908, balance unexpended	285.48
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

[a] See consolidated money statement on page 150.

The traffic in the creek is mainly for the benefit of the print works at the head of navigation. Its effect is to reduce the freight rates.

Details in reference to this work appear in the Report of the Chief of Engineers for 1893, page 1024. A sketch is printed in the Report of the Chief of Engineers for 1904, page 1051.

July 1, 1907, balance unexpended	$3,000.00
July 1, 1908, balance unexpended	3,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	3,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix E 15.)

16. Tarrytown Harbor, New York.—This harbor is located on the east shore of Hudson River, about 28 miles above New York City, where the river is several miles wide. The channel is bordered on both sides by extensive flats, that on the east side measuring about three-eighths of a mile from the main wharf to the 12-foot depth in the river. The general depth in the harbor is about 4½ feet at mean low water. Two channels, with a depth of about 6 feet, lead up to the main wharf.

The plan for improvement adopted by the river and harbor act of March 3, 1905, provides for dredging a channel along the wharf front of the harbor and connecting it north and south with deep water in Hudson River, the said channel to have a depth of 12 feet, with a width of 150 feet along the wharf front and a width of 100 feet in the northerly and southerly connections with the Hudson River. The estimated cost of this work is $26,000, increased in 1907 to $35,491.68, and $1,000 or $2,000 biennially for maintenance.

Up to June 30, 1908, $22,014.12 had been expended on this project, all in improvement. About 60 per cent of the work proposed under the project has been completed, resulting in a channel 100 feet wide and 12 feet deep, at mean low water, in the southern arm; 100 feet wide and 10 to 12 feet deep along the wharf front except opposite Husted's dock, where it is only 60 feet wide; 60 feet wide and 12 feet deep for 350 feet in length of the eastern end of the northern arm, and 60 feet wide but of less than 12 feet depth for a farther distance of 100 feet in the northern arm.

The available funds and additional appropriation recommended are to be applied to continuing the improvement and to maintenance.

The maximum draft that could be carried in the dredged channel June 30, 1908, at mean low water, from deep water in the Hudson River south of Tarrytown to Husted's wharf in Tarrytown, is estimated at 12 feet, and from deep water in the Hudson River north of Tarrytown to the same wharf at 6 feet. Mean range of tides is about 3½ feet. The total length of projected channel is about 1⅛ miles.

The tonnage and value of the commerce of this harbor, mainly in general merchandise, coal, and building materials, as obtained from the best available information, are as follows:

Year	Tons.	Value.	Year.	Tons.	Value.
[illegible]	71,201	$1,830,092	1907	86,076	$3,641,915
[illegible]	79,714	384,979(?)			

While the improvement even now is beneficial to commerce, it is not known to have caused any reduction in freight rates.

Detailed description of this harbor is printed in Reports of the Chief of Engineers for 1889, page 800, and 1900, page 1520.

July 1, 1907, balance unexpended	$16,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	12,014.12
July 1, 1908, balance unexpended	3,985.88
July 1, 1908, outstanding liabilities	1,176.15
July 1, 1908, balance available	2,809.73
July 1, 1908, amount covered by uncompleted contracts	2,538.46
Amount (estimated) required for completion of existing project	9,491.68
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	12,500.00

(See Appendix E 16.)

17. Coney Island channel, New York Harbor.—This channel lies immediately south of Coney Island, at the southwestern extremity of Long Island, New York, and is one of five channels which cross the bar that separates New York lower bay from the ocean. A channel 500 to 560 feet wide and 14 feet deep at mean low water was dredged in 1900, and in 1905 this channel was redredged to a width of 400 feet. When surveyed in 1906, the least depth on the western of two bars in the channel was about 12½ feet at mean low water and about 16 feet on the eastern bar.

The present project for improvement, adopted by the river and harbor act of March 2, 1907, provides for dredging a channel 20 feet deep at mean low water and 600 feet wide, with side slopes of 1 on 3 from deep water in the lower bay to deep water in the Atlantic Ocean at an estimated cost of $168,300, and $20,000 annually for maintenance.

It is hoped that this channel will diminish the congestion of and danger in the main channels by directing therefrom light-draft steamers and sailing vessels, long tows, and excursion vessels plying between New York and Coney Island or Rockaway Inlet.

Up to June 30, 1908, $28,165.64 had been expended on this project, all in improvement. There was received $36.67 on account of repayment and $0.33 from the sale of maps. About 16 per cent of the work proposed under the project has been completed, resulting in making a channel through the western bar 20 feet deep at mean low water and about 240 feet wide.

The available funds are to be applied to completing the improvement. No estimate is submitted for maintenance, as a recent survey strongly indicates that much of the channel dredged last fall has shoaled greatly. The indications are that the annual cost of maintenance may be as much as $50,000 or $60,000, one-third or more of the estimated cost of dredging the channel.

The maximum draft that could be carried over the shoalest part of the channel June 30, 1908, at mean low water is estimated at 12½ feet. The mean range of tides is about 4.6 feet. The total length of projected channel is about 1⅓ miles.

The commercial interests using this channel are those of the city of New York and other cities whose commerce passes Sandy Hook. It is impracticable to state what proportion of this commerce uses Coney Island channel.

It is not expected that the dredging of this channel will affect freight rates. The channel is desired principally as a means of freeing the regular channel from use by tows entering and leaving New York Harbor.

A report upon the examination and survey of Coney Island channel and map of the locality are printed in House Document No. 442, Fifty-ninth Congress, second session.

July 1, 1907, balance unexpended	$188,284.95
Receipts from sales and repayment	37.00
	188,321.95
June 30, 1908, amount expended during fiscal year, for works of improvement	28,150.59
July 1, 1908, balance unexpended	160,171.36
July 1, 1908, outstanding liabilities	14,624.46
July 1, 1908, balance available	145,546.90
July 1, 1908, amount covered by uncompleted contracts	113,496.03

(See Appendix E 17.)

18. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Wreck of ferryboat Paterson in Hudson River, New York.*—This wreck was sunk in Hudson River December 29, 1906, about opposite and 1,000 feet distant from pier 47, Manhattan, New York, N. Y. Report was submitted to the department January 18, 1907, and an allotment of $200 for the purpose of making an examination of the sunken boat was made January 22, 1907. Further allotments were made February 1, 1907, of $2,500, and April 3, 1907, of $500, for removing the obstruction.

The ferryboat was not abandoned by the owners, the Erie Railroad Company, until January 25, 1907, and for this reason proposals for removing the wreck were not invited until January 26, 1907, bids to be opened January 30, 1907.

The contract was dated January 31, 1907, and required the removal to be completed within thirty days. The contractor was delayed by ice, and the time limit was, upon the request of the contractors, waived for this reason.

The work of the contractor was examined March 4, 9, 19, and 30 and August 19, 1907, from which it was shown that the required depth over the wreck of 43 feet below mean low water had not been obtained.

A total of $1,885.39 had been expended on this work to June 30, 1908.

(*b*) *Wreck of canal boat Mamie Doherty in Hudson River, New York.*—This boat grounded on the channel bank of Hudson River, off the mouth of Poesten Kill, Troy, N. Y., November 20, 1906, and subsequently broke in two. It was reported to the department April 20, 1907, and an allotment of $1,100 for its removal was made April 24, 1907. The lowest bid received in response to written notice, dated April 9, 1907, was for $950, which was accepted. Removal was completed July 27, 1908, at a cost of $950.

(*c*) *Wreck of lighter Hero in Newtown Creek, New York.*—The *Hero* sunk in about 18 feet of water, mean low water, at the junction of Newtown Creek and English Kills, seriously obstructing navigation in that vicinity. It was reported to the department on June 24, 1907, and an allotment of $235 for its removal was made June 26, 1907.

Proposals for its removal were invited verbally, and the lowest bid received was for $200. Award was made on June 24, 1907, and the wreck was reported removed on June 28, 1907. An inspection made on July 8, 1907, showed that the wreck had been completely removed. The cost of removal was $235.

(*d*) *Wreck of canal boat in entrance to Pugleys Creek, north of Classons Point, East River, New York.*—This wreck was reported June 10, 1907, by parties desiring to deliver a large quantity of material destined for a point in the creek above the obstruction.

Proposals for its removal were invited by written notice dated June 21, 1907, bids to be opened June 26, 1907, all wreckage to become the property of the successful bidder. Award was made to the lowest bidder, who proposed to do the work for $594.

As it was important to remove the obstruction without unnecessary delay, an allotment of $650 to pay the cost of removal and expenses incidental thereto was requested by telegraph June 26, 1907, and an allotment of this amount was made the same day.

Work on the wreck was commenced June 28, 1907, and was completed August 13, 1907, at a cost of $650.

(*e*) *Wreck of canal boat D & H No. 3079.*—This boat floated from Piermont Pier and sunk in Hudson River, opposite Nyack, N. Y. Removal was completed July 19, 1907, at cost of $315.

The cost of removal was subsequently recovered from the owner of the boat and the amount, $315, was deposited to the credit of the United States Treasurer October 29, 1907.

(*f*) *Wreck of schooner Deborah T. Hill.*—This vessel obstructed navigation in the Harlem River, New York, in the vicinity of a coal dock on Wards Island.

In response to verbal request the lowest bidder proposed to remove the wreck for $124.

Removal was completed April 20, 1908, at a total cost of $140.

(See Appendix E 18.)

EXAMINATIONS AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and survey required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination, with plan and estimate of cost of improvement of Minisceongo River, New York, with a view to obtaining a depth of 7 feet.*—Reports dated April 26 and May 21, 1907, respectively, are printed in House Document No. 79, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $22,632 is presented.

2. Preliminary examination from Peters Neck Point through Long Beach Bay to Horn River, New York.—Report dated August 30, 1907, is printed in House Document No. 447, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

3. Preliminary examination of Jamaica Bay, New York, with a view to obtaining a channel 100 feet wide and 6 feet deep to and through Great South Bay to Peconic Bay, including channels to Parsonage and Sumpawams rivers and Freeport and Massapequa creeks.—Report dated July 17, 1907, is printed in House Document No. 449, Sixtieth Congress, first session. The improvement is not considered worthy of being undertaken by the General Government.

4. Preliminary examination of Hempstead Harbor, New York, with a view to obtaining a depth of 6 feet.—Report dated September 4, 1907, is printed in House Document No. 463, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

5. Preliminary examination with plan and estimate of cost of improvement of shoal off Stuyvesant Harbor, Hudson River, New York.—Reports dated September 24 and October 25, 1907, are printed in House Document No. 491, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States at this time.

6. Preliminary examination of channel between Threemile Harbor and Gardiners Bay, New York.—Report dated August 8, 1907, is printed in House Document No. 503, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

7. Preliminary examination and survey of Hudson River, New York, with a view to obtaining a depth of 12 feet from the channel to Upper Nyack and the contiguous towns of Nyack, South Nyack, Grand View, and Piermont, through the pier to the mouth of Sparkill River, and east to the main channel.—Reports dated July 16, 1907, and March 31, 1908, respectively, are printed in House Document No. 959, Sixtieth Congress, first session. The improvement is not considered worthy of being undertaken by the United States.

The local officer was also charged with the duty of making other preliminary examinations and surveys provided for in the river and harbor act of March 2, 1907, as follows, and reports thereon will be duly submitted when received:

1. Port Chester Harbor, New York.

2. Echo Bay, New York.

3. East Chester Creek, New York.

4. Jamaica Bay, including entrance to said bay at Rockaway Inlet and those waters having their outlet in Dead Horse Inlet, New York.

5. East River, between North Brother and South Brother islands.

IMPROVEMENT OF RIVERS AND HARBORS IN THE SECOND NEW YORK, NEW YORK, DISTRICT.

This district was in the charge of Col. W. L. Marshall, Corps of Engineers. Division engineer, Col. D. W. Lockwood, Corps of Engineers.

1. New York Harbor, New York.—Before the improvement of the main entrance into New York Harbor was undertaken by the United

States the least depth in midchannel on the outer bar was 23.7 feet at mean low water and about the same across three other shoals between the bar and deep water in the harbor. A large proportion of the commerce of the port, carried in vessels of greater draft, could cross these shoals only at or near high water.

The project for the improvement of Gedney channel was approved by the Secretary of War December, 1884, and extended to cover the whole of the main entrance to the harbor December, 1886. It provided for dredging a channel 1,000 feet wide and 30 feet deep at mean low water from deep water below the Narrows, through Main Ship and Gedney channels to deep water outside the bar. The estimated cost was $1,490,000 for dredging 4,300,000 cubic yards. The actual amount dredged to October, 1891, when the work was approximately completed, was 4,875,079 cubic yards.

The existing project for maintenance of channels was approved November 15, 1892. The cost of this work varies in different years; it is estimated as averaging about $80,000 annually.

Under these projects the amount expended up to June 30, 1908, is $2,146,335.03, of which $628,310.51 has been applied to maintenance of channels in the sixteen years since 1892, when the original project was completed.

As a result of these expenditures, channels to the sea have been obtained with a depth of 30 feet at mean low water and width of 1,000 feet or over, and have been maintained for the full depth with, as nearly as possible, the full width.

During the fiscal year ending June 30, 1908, 351,139 cubic yards of mud and sand has been removed from the west side of Main Ship channel, deepening the shoals which form along the channel edges. In this channel the tide currents run across the course of the channel and wash in and deposit large amounts of silt along the edges, requiring continuous work for maintenance. A full depth of 30 feet is maintained in the middle of this channel for a width of 600 to 800 feet. Bayside and Gedney channels, which are farther seaward and more nearly true with the tide currents, require comparatively little dredging to maintain their full depth and width.

The length of that part of New York Harbor included in the limits of the project for improvement (from Atlantic Ocean to the Battery, New York City) is 22½ miles by way of Sandy Hook, and (June 30, 1908) the channel has a depth of 30 feet or over throughout its entire length. For a length of about 8 miles this depth was made and is maintained under the project. The mean rise of tide is 4½ feet.

Future appropriations will be applied to the maintenance of these channels.

By the terms of the river and harbor act of 1899 a project was adopted for making an entrance to New York Harbor by way of Ambrose channel (formerly known as East channel), to be 2,000 feet wide and 40 feet deep at mean low water. It involves excavation of about 42,500,000 cubic yards of material for a length of 7 miles of channel. The work was authorized to be done under a continuing contract at a cost not exceeding $4,000,000. Under act of March 3, 1903, two United States dredges were built to supplement the contract work, which was far behind the required rates. In October, 1906, the contractor abandoned the work, and the river and harbor act of

1907 authorized the building of two more United States dredges and changed the authorized limit for completion to $5,148,510. The sum of $951,510 is yet to be appropriated under the contract authorizations.

The original available depth through this chanel was 16 feet at mean low water, the shoalest part being the outer bar. The channel was used only by towboats, scows, and other light-draft vessels.

To July 1, 1908, $3,360,379.06 had been expended under this project in building four dredges and in excavating 32,124,442 cubic yards of sand, mud, and stones. For details of dredge construction see Appendix H 9.

During the fiscal year ending June 30, 1908, two United States dredges were continuously engaged upon this work, excavating 5,362,376 cubic yards of sand and mud; two other dredges were completed and began work a few days before the close of the fiscal year, excavating 133,148 cubic yards; a dredge from another district was employed for a few weeks, removing 300,571 cubic yards, and under minor contracts for removing old stone dumps from the channel 10,134 cubic yards of stones mixed with sand was taken out. This channel has now a continuous depth of 35 feet with width of 700 feet or over, and through three-fourths of its length it has already a depth of 40 feet. It is easily navigable at mean low tide for ships of 35 feet draft, and has a maximum possible draft of 38 feet. The project is regarded as about 62 per cent completed.

Ambrose channel was buoyed for navigation in September, 1907; regulations were issued by the Secretary of War restricting its use to daylight navigation by ships of 29 feet draft or over, or of 600 feet length or over—ships whose depth or length were not sufficiently accommodated by the old channel. It has since been used regularly by ships of the permitted size.

Future appropriations will be applied to first making a continuous navigable depth of 40 feet throughout the channel, and subsequently to widening it to the projected width.

By the river and harbor act of 1905 the removal of a rock in North River near pier 1 was authorized, and funds were provided by withdrawing $20,000 from the Ambrose channel appropriation, in addition to $25,000 similarly diverted by joint resolution of Congress approved July 1, 1902. A contract has been entered into for the entire removal of the rock to 40 feet depth, at cost of $40,000, the whole area of the rock has been drilled and blasted, and up to the close of the fiscal year 280 cubic yards of rock (about one-fifth of the whole) has been taken out. The amount expended is $818.87.

The foreign exports and imports for the port of New York during the year ending June 30, 1907, amounted approximately to 12,317,000 tons, valued at $1,613,110,384, being an increase over the valuation of 1886, before improvement of the entrance was begun, of $772,833,692. The entire cost of the improvement of New York Harbor up to date is less than 1 per cent of the increase in valuation of foreign commerce alone for this port since the improvement began, and less than one-half of 1 per cent of the present annual value of foreign commerce.

No statistics of local and coastwise domestic commerce are kept.

It is impossible to estimate the effect of the improvement upon freight rates. During 1907, 152 different ships drawing 27 feet or

Future appropriations will be applied to completing the channels to 35 feet depth, subsequently deepening them to 40 feet, as authorized by the river and harbor act of March 2, 1907.

The commerce of this part of the port of New York consists of coffee, sugar, cotton, coal, and miscellaneous freights, chiefly from foreign ports; in 1907 it amounted to approximately 4,204,000 tons, of an estimated value of $162,000,000.

Further details concerning these channels are contained in the Annual Report of the Chief of Engineers for 1899, page 1266.

House Document No. 337, Fifty-fourth Congress, second session, contains a report upon a survey of these channels, with map showing locations and depths as existing in 1897. (See Annual Report of the Chief of Engineers for 1897, p. 1177.)

The effect of the improvement projected is undoubtedly to lower freight rates; these rates depend so largely upon the amount of business in hand and upon competition that it is impracticable to separate the effect of the improvement upon rates. A notable effect has been the growth of foreign commerce and the class of ships which carry it, many of which could not have entered Bay Ridge channel before its improvement.

July 1, 1907, balance unexpended	$456,719.57
Received from sale of maps	4.80
	456,724.37
June 30, 1908, amount expended during fiscal year for works of improvement	194,363.36
July 1, 1908, balance unexpended	262,361.01
July 1, 1908, outstanding liabilities	54,833.45
July 1, 1908, balance available	207,527.56
July 1, 1908, amount covered by uncompleted contracts	200,853.11
Amount (estimated) required for completion of existing project	2,051,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897.	300,000.00

(See Appendix F 2.)

3. Enlargement of Governors Island, New York Harbor.—The project for this entire work, adopted under the terms of the sundry civil act of 1901, which made appropriations for beginning operations, included an addition of about 82 acres to the area of the island by inclosing with a bulkhead part of the shoal southwest of the island and filling the inclosure, the building of a wharf on the north shore and dredging to a depth of 26 feet in front of the wharf, and the erection of buildings. The work of enlargement, including construction of a wharf and dredging, all estimated to cost $1,100,000, was assigned to the Engineer Department. By a modification of the project adopted in April, 1902, the enlargement was to be extended southwest over the shoal to reclaim an additional area of about 19 acres, making the total area of the enlargement about 101 acres. This will necessitate an increase in the estimate of cost to cover this work, and construction of about 600 feet of sea wall

around it; but this amount can not be definitely stated pending a determination of the details of the plan.

Work was begun in August, 1901, and up to June 30, 1908, $696,715.07 had been expended.

During the fiscal year, 1,181,225 cubic yards of filling material was delivered in the inclosure, of which 597,750 yards was placed above mean low water in the embankment, under a contract still in progress; minor repairs were made to the sea wall; and a light and fog bell were maintained at the southwest curve of the sea wall.

The entire work done to June 30, 1908, consists in building a pile wharf, with a T head, 370 feet long, dredging the approaches 26 feet deep, laying intercepting sewers, building 6,795 linear feet of riprap bulkhead to inclose the area of enlargement, and upon the bulkhead building 6,775 linear feet of masonry sea wall, and in building an embankment to cover 67 acres above low water, 32 acres of which have been built up to final grade.

The sea wall is completed, except a gap of 350 feet clear width, left to permit bringing in material for the embankment.

The available funds will be applied to continuing embankment construction.

Future appropriations will be applied to continuing and completing the project.

July 1, 1907, balance unexpended		$426,112.50
Amount appropriated by sundry civil act approved May 27, 1908		75,000.00
Received from sale of maps		2.60
		501,115.10
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$100,118.87	
Treasury settlement No. 2482	72,708.70	
		172,827.57
July 1, 1908, balance unexpended		328,287.53
July 1, 1908, outstanding liabilities		30,655.13
July 1, 1908, balance available		297,632.40
July 1, 1908, amount covered by uncompleted contracts		152,395.14
Amount (estimated) required for completion of existing project		Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897.		75,000.00

(See Appendix F 3.)

4. Removing sunken vessels or craft obstructing or endangering navigation—Coal barge Addie B. Bacon.—This coal-laden barge sunk on the east side of Main Ship channel in February, 1908, and after the coal had been removed was abandoned by the owners. The boat was removed bodily and taken to Rikers Island, where it will soon be covered by the embankment now in progress at that place. The amount expended was $2,100.

(See Appendix F 4.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE THIRD NEW YORK, NEW YORK, DISTRICT.

This district was in the charge of Col. D. W. Lockwood, Corps of Engineers, division engineer, eastern division.

1. Passaic River, New Jersey.—This river is a stream of considerable size, rising among the highlands in the northern part of New Jersey and flowing in a generally easterly and southerly course into Newark Bay. It is navigable from its mouth to Passaic, a distance of about 16 miles, where navigation is cut off by the Dundee Water Power and Land Company's dam. In its natural condition the navigable depth to Newark was about 7 feet at mean low water; from Newark to Passaic it was about 3 feet.

The first project for improvement, adopted by the river and harbor act of June 10, 1872, was for providing a channel from Newark to Passaic from 6 to 7½ feet deep and from 50 to 200 feet wide, the first cost being estimated at $123,924. This was subsequently increased to $193,822.

The second project was for improving the river below Newark and was authorized by the river and harbor act of June 14, 1880, at an estimated cost of $353,875. It proposed a channel 200 feet wide and 10 feet deep at mean low water up to Center Street Bridge, Newark.

The two projects were consolidated by the river and harbor act of July 13, 1892, the estimated cost of the improvement being $547,697.

The amount expended under this consolidated project up to the close of the fiscal year ending June 30, 1908, was $499,777.08, of which $389,610 was used in carrying out the projects and $110,167.08 for maintenance.

Existing projects: That adopted by act of June 13, 1902, in accordance with the report submitted in House Document No. 401, Fifty-sixth Congress, first session, provides for making a channel from Staten Island Sound through Newark Bay and the said river to the Montclair and Greenwood Lake Railroad bridge 12 feet deep to the Nairn Linoleum Works, and 10 feet deep from that point to the said railroad bridge, a total distance of 10.8 miles. The estimated cost was originally $296,000, but was subsequently increased, additional funds having been appropriated by the river and harbor act of March 3, 1905, and may now be stated at $323,274.60. Work under this project was authorized to be done under continuing contracts, the total amount of the contract authorization being now appropriated. The yearly cost of maintenance is estimated at $10,000. The amount expended on this project up to the close of the fiscal year ending June 30, 1908, was $245,564.35.

By the passage of the river and harbor act approved March 2, 1907, a project has been adopted which provides for making a channel 16 feet deep at mean low water, 300 feet wide from deep water in Newark Bay to the Nairn Linoleum Works, 9.7 miles, thence 200 feet wide to the Montclair and Greenwood Lake Railroad bridge, 1.1 miles, in accordance with the report submitted in House Document No. 441, Fifty-ninth Congress, second session, estimated to cost $1,216,775. The act provides for an expenditure of $850,000 for prosecuting the work, of which $585,000 is yet to be appropriated under continuing-contract authorization. The amount expended on this project to the close of the fiscal year ending June 30, 1908, was $104,963.97.

The projects of 1902 and 1907 for the lower part of the river include the old project below Newark, but leaves in force the part above Newark which is included between the Montclair and Greenwood Lake Railroad bridge and the city of Passaic, a distance of 6 miles. The work accomplished under this part of project consists of dredging a channel 6 feet deep at mean low water and with widths of from 90 to 100 feet through the shoals to the city of Passaic. Up to June 30, 1908, $209,950.54 had been expended on this part of the project, of which $150,734 was expended for the project and $59,216.54 for maintenance work. The annual cost of maintenance is estimated at $5,000. This project is practically completed.

During the past fiscal year dredging has been carried on under four contracts:

1. Under project of June 13, 1902, operations consisted in dredging under a continuing contract with P. Sanford Ross (Incorporated), 104,156 cubic yards of material being removed between the Center Street Railroad bridge and the Montclair and Greenwood Lake Railroad bridge. Work was in progress at the close of the year.

2. Under project of June 13, 1902, operations consisted in dredging under contract with the International Contracting Company, 111,745 cubic yards of material being removed between the New York and Lake Erie Railroad bridge and the Montclair and Greenwood Lake Railroad bridge. Work was in progress and contract nearly completed at the close of the year.

Channels of 12 feet depth and 200 feet in width have been completed from Newark Bay to the Nairn Linoleum Works, and of 10 feet depth and 200 feet width for a distance of 3,420 feet above that point. This project is nearly completed. There remains about 6 per cent of the work to be done.

3. Under project of March 2, 1907, operations consisted in dredging under a continuing contract. Dredging was commenced on August 28, 1907, and was in progress at the close of the year, at which time 779,708 cubic yards of material had been removed from Newark Bay and Passaic River, and the 16-foot channel had been carried through the bay and lower end of the river with width of about 150 feet for an aggregate distance of about 4 miles.

4. Under project of June 10, 1872, operations consisted in dredging for maintenance under contract of John and Joseph McSpirit, 12,376 yards of material and 12.05 cubic yards of bowlders being removed. This contract was in progress at the beginning of the year and was completed September 26, 1907.

The maximum drafts that could be carried June 30, 1908, were as follows: 16, 12, and 10 feet, as above stated, below the Montclair and Greenwood Lake Railroad bridge, and 6 feet from that bridge to the city of Passaic. Mean range of tides: At mouth of river, 4.7 feet, and at Passaic, 2.5 feet.

It is proposed to apply the amount estimated as a profitable expenditure to continuation and maintenance of the improvement in accordance with the adopted projects.

The commerce of this river is mainly in building material, iron ore, fertilizers, coal, and general merchandise, and amounted to 2,037,363 tons in 1900, to 2,009,356 tons in 1901, to 2,494,312 tons in 1902, to 2,356,511 tons in 1903, to 2,567,942 tons in 1904, to 2,567,000 tons in

1905, to 2,577,188 tons in 1906 and also in 1907, valued at $167,113,305, including the commerce of Hackensack River, which passes through Newark Bay.

This improvement is necessary to the great industrial interests, and has reduced freight rates $1 a ton on coal and building materials, and its continuance is necessary to the successful carrying on of the business of this locality.

Details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1896, pages 770–774, and for 1900, pages 177, 1530–1550.

Reference to reports of examinations and surveys is noted in the Annual Report of the Chief of Engineers for 1907, page 156.

Maps showing mouth of river and Newark Bay are printed in the Annual Reports of the Chief of Engineers for 1882, page 686, and 1887, page 766, and maps of the river in the vicinity of and above Newark are printed in House Document No. 401, Fifty-sixth Congress, first session, and of the full length of the bay and river under improvement in the Annual Report of the Chief of Engineers for 1905, page 1030.

July 1, 1907, balance unexpended		$398,535.64
Amount appropriated by sundry civil act approved May 27, 1908		65,000.00
Received from sale of maps during the year		51.55
		463,587.19
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$154,984.00	
For maintenance of improvement	16,479.94	
		171,463.94
July 1, 1908, balance unexpended		292,123.25
July 1, 1908, outstanding liabilities		46,267.33
July 1, 1908, balance available		245,855.92
July 1, 1908, amount covered by uncompleted contracts		569,677.22
Amount (estimated) required for completion of existing project		951,775.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908:		
For works of improvement	$300,000.00	
For maintenance of improvement	10,000.00	
		310,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix G 1.)

2. *Arthur Kill, or Staten Island Sound, and channel between Staten Island and New Jersey.*—(*a*) *Arthur Kill, or Staten Island Sound, New York and New Jersey.*—This is a waterway about 12 miles long, which, together with the lower end of Newark Bay, 2 miles long, and the Kill van Kull, 3 miles long, forms the inland waterway between upper New York Harbor and Raritan Bay. The section now contemplated under this improvement consists of the 14 miles of channel between Kill van Kull and Raritan Bay. The original depth through the Arthur Kill, or Staten Island Sound, at mean low water was 15 feet and upward, in a channel 100 to 1,000 feet in width. Through the lower end of Newark Bay the navigable channel depth was about 14 feet at mean low water, the result of an improvement commenced in 1874 and continued up to the present time. In the present project

the new channel was cut through the flats to the southward of the original channel on which the depth was 1 to 2 feet at mean low water.

Projects: Sections of this waterway have been under improvement by the United States under the titles of "Channel between Staten Island and New Jersey," adopted in 1880, superseding the project of 1874, and "Arthur Kill," adopted in 1888. The former provided for a depth of 14 feet and width of 400 feet through the lower part of Newark Bay, and the latter for the removal of Steep Point, in order to straighten the channel to the southwestward of the Baltimore and Ohio Railroad bridge.

Details and references as to these projects are printed in current report under the head of "Channel between Staten Island and New Jersey," which project is still in force.

The existing project for this improvement, adopted by the river and harbor act approved June 13, 1902, provides for making and maintaining a channel from Kill van Kull to Raritan Bay, New York and New Jersey, by means of dredging and diking, 300 feet wide and 21 feet deep at mean low water, at an estimated cost of $696,000, and $5,000 for annual cost of maintenance. Work under this project is authorized to be done under continuing contracts, $241,000 of the authorization still remaining to be appropriated. The amount expended on the project to June 30, 1908, was $341,458.95.

Operations during the past fiscal year consisted in dredging, under a continuing contract, approved by the Department on October 27, 1903, upon which work was commenced on December 2, 1903. During the year 749,686 cubic yards of material was removed from several sections of the channel between Shooters Island and Carteret. About two-thirds of the dredging contemplated by this project has been completed, and the 21-foot channel has been carried nearly through the waterway, with widths of from 150 to 300 feet. The undredged part is a short section at Carteret about 2,200 feet in length, which at the present rate of progress will be completed within two months. The 21-foot channel will then be open to navigation, and there will remain to be accomplished the widening of the channel to 300 feet.

The maximum draft that could be carried through the waterway on June 30, 1908, was about 20 feet at mean low water, except in the section mentioned above as not dredged where the depth is 15 feet at mean low water. Mean range of tides, 5 feet.

It is proposed to apply the amount estimated as a profitable expenditure to dredging for the continuation of the improvement in accordance with the adopted project.

The freight carried through this waterway consists of oil, coal, ores, clay products, chemicals, fertilizers, grain, machinery, manufactures, and general merchandise, and amounted in 1899 to 11,311,991 tons, in 1900 to 11,047,633 tons, in 1901 to 11,651,300 tons, in 1902 to 14,517,079 tons, in 1903 to 11,512,420 tons, in 1905 to 11,721,861 tons, valued at $265,193,813; in 1906 to 16,574,840 tons, valued at $355,579,817, and in 1907 to 14,948,077 tons, valued at $245,032,666.

It appears from inquiry that no estimate can be made of the exact effect of the project on freight rates, except to the local commerce. The rates on this have been reduced by this improvement, and will

be further reduced when the improvement has advanced to the extent of providing a practicable navigable channel of 21 feet.

References to reports of examinations and surveys are noted in the Annual Reports of the Chief of Engineers for 1904, page 137, and for 1907, pages 157 and 158.

Report on preliminary examination of Arthur Kill at the westerly side of Buckwheat Island is printed in House Document No. 533, Sixtieth Congress, first session, and in Annual Report of the Chief of Engineers for 1906, page 167.

Maps of this work are printed in House Document No. 393, Fifty-sixth Congress, first session, and in the Annual Report of the Chief of Engineers for 1905, page 1034.

July 1, 1907, balance unexpended	$224,293.13
Received from sale of maps during the year	10.40
	224,303.53
June 30, 1908, amount expended during fiscal year for works of improvement	110,745.48
July 1, 1908, balance unexpended	113,558.05
July 1, 1908, outstanding liabilities	43,135.88
July 1, 1908, balance available	70,422.17
July 1, 1908, amount covered by uncompleted contracts	171,883.96
Amount (estimated) required for completion of existing project	241,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908	200,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(*b*) *Channel between Staten Island and New Jersey.*—This channel is an inland waterway, about 17 miles long, connecting New York Harbor with Raritan Bay. It consists of the Kill van Kull, connecting the upper bay with Newark Bay, and the Arthur Kill, connecting Newark Bay with Raritan Bay.

The natural depth through the channel was 15 feet or more, except for a distance of about 1¾ miles in Newark Bay, where there was a shoal with a crooked channel 9½ feet deep, bordered by flats with depth of about 2 feet of water. The improvement of the "channel between Staten Island and New Jersey" consists in the deepening of the channel across this shoal.

The first project, adopted by the river and harbor act of June 23, 1874, was for making this channel from 14 to 16 feet deep, at an estimated cost of $443,211. The only work done under it was the building of 2,237 linear feet of diking, at a cost of $50,000.

The second and existing project was adopted in 1880, which, with subsequent modifications, proposed to dredge through the shoal a channel 400 feet wide and 14 feet deep at mean low water, the cost being estimated at $210,000.

A supplemental project was adopted by the river and harbor act of August 11, 1888, which had for its object the removal of the point of land known as "Steep Point," for the straightening of the channel to the westward of the Baltimore and Ohio Railroad bridge. This work was carried on under the title of "Improvement of Arthur Kill,

New York and New Jersey," 1888–1895. The cost was estimated at $26,500, and the work was completed in 1895, at a cost of $25,401.30. This modification of the project brought the total cost of the improvement up to $286,500.

The river and harbor acts of June 3, 1896, and June 13, 1902, extended the project to include the dredging of a channel in Lemon Creek, on Staten Island, at a cost of $5,000 and $5,000, respectively.

This extension increased the total estimated cost of the improvement from the beginning to $296,500. Annual maintenance is estimated at $10,000.

The total amount expended to June 30, 1908, on the project, with its additions and modifications, was $308,796.44, which was applied to diking, to dredging a channel 14 feet deep and 400 feet wide through the shoal in Newark Bay, to removing Steep Point, and to dredging a channel in Lemon Creek 8 feet deep at high water and from 35 to 50 feet wide; $206,635.08 has been expended in carrying out the project and $102,161.36 for maintenance. The work contemplated under this project has been completed.

No work was done during the fiscal year, the channel having been reported in good condition, the result of dredging in the preceding season of 1906–7.

It is proposed to apply the available balance and the amount recommended as a profitable expenditure to the maintenance of the improvement.

The maximum draft that could be carried June 30, 1908, through the channel between Staten Island and New Jersey was about 14 feet at mean low water and in Lemon Creek about 6 feet at mean high water to the head of navigation, a distance of about one-half mile from the mouth. Mean range of tides, 5 feet.

The freight carried through this channel consists of oil, coal, ores, clay products, chemicals, fertilizers, grain, machinery, manufactures, and general merchandise, and amounted in 1899 to 11,311,991 tons, in 1901 to 11,651,300 tons, in 1902 to 16,266,574 tons, in 1903 to 14,129,678 tons, in 1905 to 14,339,120 tons, valued at $325,625,465, and in 1906 to 17,097,799 tons, valued at $396,266,084.

This is a connecting channel and no estimate can be made of the exact effect on the rates of freight, but it is known that the present commerce could not be carried on without this improvement, from which it is inferred that rates would be advanced if this improvement had not been made.

Further details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1887, Part 1, page 743; for 1890, page 843; for 1896, page 775; for 1897, pages 1130–1132, and for 1900, page 1525.

Reference to reports on examinations and surveys are noted in the Annual Report of the Chief of Engineers for 1907, page 160.

Maps of this improvement are printed in the Annual Reports of the Chief of Engineers for 1881, page 696; 1889, pages 820–822; 1890, page 844, and 1905, page 1036, and in House Document No. 393, Fifty-sixth Congress, first session. Map of Lemon Creek is printed in the Annual Report of the Chief of Engineers for 1905, page 1036.

July 1, 1907, balance unexpended	$2,703.56
July 1, 1908, balance unexpended	2,703.56
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	20,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

CONSOLIDATED.

July 1, 1907, balance unexpended	$226,996.69
Received from sale of maps during the year	10.40
	227,007.09
June 30, 1908, amount expended during fiscal year for works of improvement	110,745.48
July 1, 1908, balance unexpended	116,261.61
July 1, 1908, outstanding liabilities	43,135.88
July 1, 1908, balance available	73,125.73
July 1, 1908, amount covered by uncompleted contracts	171,883.96
Amount (estimated) required for completion of existing project	241,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908:	
For works of improvement $200,000.00	
For maintenance of improvement 20,000.00	
	220,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix G 2.)

3. Woodbridge Creek, New Jersey.—This creek is a small, crooked tidal stream, about 5 miles long, running through flat marshes for most of its length and emptying into the west side of Arthur Kill, or Staten Island Sound, 2 miles north of Perth Amboy, N. J.

It is navigable for 2⅜ miles above the mouth to a point where it is crossed by a highway bridge without a draw. The width of the creek below this bridge is about 100 feet. In its original condition this stream was obstructed at its mouth by a bar having a least depth of 9.8 feet at high water, and by two shoals just inside the mouth. From these shoals a good 12-foot channel existed to above Anderson's brickworks, seven-eighths of a mile from the mouth, above which point, however, many shoals occurred, although a narrow 8-foot channel existed as far as Salamander dock, 1⅞ miles from the mouth.

First project: A survey of the navigable part of this creek was made in 1878, reference to which is made on page 139 of the Annual Report of the Chief Engineers for 1904, and a project for its improvement was adopted by the river and harbor act of March 3, 1879. This project provided for forming a channel 12 feet deep at mean high water and 80 feet wide from the mouth of the creek to the Salamander dock at an estimated cost of $13,800, which amount was increased in 1884 to $29,000. Work on this improvement was carried on under appropriations made from 1879 to 1882, amounting to $19,000, which was expended without completing the project, and was suspended in 1883, and in 1900 the channel had relapsed to its original condition.

The existing project, adopted by the river and harbor act of June 13, 1902, contemplates obtaining a channel 8 feet deep at mean low water, with a bottom width of 50 feet, by dredging, from Arthur Kill to Salamander dock, at an estimated cost of $35,000 for the improvement and $3,000 annually for maintenance. Reference to this project, and of the examination and survey upon which it is based, is contained in the Annual Report of the Chief of Engineers for 1904, page 139.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1908, was $41,821.84, of which $30,822.70 was used in carrying out the project and $10,999.14 for maintenance. During the past fiscal year 54,814 cubic yards of material was removed from the channel under a contract for completing improvement and maintenance, in accordance with act of March 2, 1907. The channel was practically restored to proposed dimensions and the project completed.

The maximum draft that could be carried June 30, 1908, over the shoalest part of the channel was 7 to 8 feet at mean low water. The mean range of tides is 5 feet.

The commerce of this creek, mainly in clay, brick, tile, coal, tin scrap, steel scrap, and building materials, amounted in 1887 to 126,000 tons, in 1898 to 176,000 tons, in 1903 to 155,751 tons, in 1904 to 165,313 tons, in 1905 to 160,194 tons, valued at $1,018,198, in 1906 to 167,392 tons, valued at $1,128,237, and in 1907 to 151,671 tons, valued at $1,071,548.

It appears from inquiry that freight rates have been reduced as a result of this improvement.

It is proposed to apply the sum estimated as a profitable expenditure in fiscal year ending June 30, 1910, to maintenance of improvement.

Maps of the creek are printed in House Document No. 282, Fifty-sixth Congress, first session, and in Annual Report of the Chief of Engineers for 1905, page 1036.

July 1, 1907, balance unexpended		$19,443.40
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$15,500.00	
For maintenance of improvement	3,015.24	
		18,515.24
July 1, 1908, balance unexpended		928.16
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		9,000.00

(See Appendix G 3.)

4. Raritan Bay, New Jersey.—This bay is a large body of water lying between the southern end of Staten Island and the New Jersey shore. Its greatest width north and south is about 5 miles and its greatest length east and west is about 7 miles. The Raritan River empties into it at its west end, between Perth Amboy and South

Amboy, and the Arthur Kill, or Staten Island Sound, extends northward, connecting it with Newark Bay.

This bay had naturally a fairly straight channel, 11 feet deep, to South Amboy. The line of the deepest water, however, followed the Staten Island shore from Perth Amboy to Seguine Point, where it was separated from deep water in the eastern part of the bay by a shoal 1.5 miles broad, with a minimum depth of 14.5 feet.

The original and existing project, adopted March 3, 1881, and extended September 19, 1890, and June 3, 1896, provides for dredging channels 300 feet wide and 21 feet deep from Seguine Point to deep water in the bay, a distance of about 1.5 miles, through two shoals opposite Wards Point, 0.4 and 0.6 mile long, respectively, and from South Amboy to deep water near Great Beds light, a distance of about 1.5 miles. The estimated cost of the work is $507,875.

Reference to reports on examinations and surveys are noted in the Annual Report of the Chief of Engineers for 1904, pages 140 and 1158.

The amount expended on the work up to the close of the fiscal year ending June 30, 1908, was $537,715.68, of which $297,314.45 was used in carrying out the project and $240,401.23 for maintenance. The project has been completed, and the only work now contemplated is maintenance of the improvement.

Operations during the fiscal year consisted in dredging under contract for maintenance. Work was commenced on May 22, 1908, and was in progress at the close of the year, at which time 26,974 cubic yards of material had been removed from the Seguine Point channel and 30,080 yards from the South Amboy channel.

Examinations of the three channels were made in June, and the maps were completed in July, 1907. These examinations showed that no further dredging was necessary in 1907.

It is proposed to apply the amount recommended as a profitable expenditure for maintenance.

The maximum draft that could be carried June 30, 1908, through the Wards Point, South Amboy, and Seguine Point channels was 21 feet at mean low water. Mean range of tides, 5 feet.

The commerce of the bay is mainly in coal, brick, refined lead and copper, bullion, clay products, and general merchandise, and amounted in 1901 to 4,722,048 tons, in 1902 to 5,453,122 tons, in 1903 to 4,484,152 tons, in 1905 to 5,296,986 tons, in 1906 to 6,432,245 tons, valued at $114,358,610, and in 1907 to 7,424,414 tons, valued at $139,228,344.

It appears from statements of the shipping interests of the great railroad terminals that the improvements have resulted in a great reduction of towing rates and a proportionate reduction of freight rates, owing to the greater quantity of coal that can be carried and towed through these channels over that which was carried before the improvement was made.

Further details of this improvement are printed in the Annual Report of the Chief of Engineers for 1896, pages 787–789. Maps are printed in the Annual Report of the Chief of Engineers for 1905, page 1038.

July 1, 1907, balance unexpended	$32,494.38
Received from sale of maps during the year	3.00
	32,497.38
June 30, 1908, amount expended during fiscal year for maintenance of improvement	7,709.86
July 1, 1908, balance unexpended	24,787.52
July 1, 1908, outstanding liabilities	10,137.61
July 1, 1908, balance available	14,649.91
July 1, 1908, amount covered by uncompleted contracts	10,075.69
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	40,000.00

(See Appendix G 4.)

5. Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth rivers, Shoal Harbor and Compton Creek, and Cheesequake Creek, New Jersey.—(*a*) *Keyport Harbor.*—This harbor is situated at the mouth of Matawan Creek, on the south side of Raritan Bay, 5 miles east of the mouth of Raritan River, and it consists of a bay about 1 mile broad.

There was no distinct natural channel in the harbor, the available depth to the wharves being less than 4 feet at mean low water. A 6-foot channel had been dredged at private expense before the United States assumed charge of the improvement, but it had shoaled again to 3 feet.

The original and existing project, approved August 2, 1882, with subsequent modifications (1884), contemplates dredging a channel 8 feet deep at mean low water about 4,700 feet long and 200 feet wide from Raritan Bay to the steamboat dock at Keyport, at an estimated cost of $40,475. Reference to report on examination and survey is noted in the Annual Report of the Chief of Engineers for 1904, page 141.

The amount expended to June 30, 1908, was $59,518.83, of which sum $30,500 was used in carrying out the project and $29,018.83 for maintenance. A channel of the required length and nearly the proposed width was completed in 1883–84. Deterioration to the amount of about 70 per cent now exists.

No work was done on the improvement during the fiscal year. Under an allotment of $8,705.97 from the consolidated appropriation, act of March 2, 1907, a contract for dredging is in force and preparations for beginning work were in progress at the close of the year. The available funds will probably be sufficient to restore the dredged channel to projected depth and to one-half projected width.

The maximum draft that could be carried June 30, 1908, to the Keyport wharves was about 7 feet at mean low water. Mean range of tides, 4.9 feet.

The commerce of this harbor is mainly in farm products, fertilizers, coal, lumber, fish, shellfish, and miscellaneous freight, and amounted to 67,500 tons in 1899, to 45,000 tons in 1901, to 62,000 tons in 1903, to 70,000 tons in 1904, to 86,821 tons in 1905, valued at $2,202,105, in

1906 to 229,377 tons, valued at $3,074,060, including the commerce of Matawan Creek, and in 1907 to 160,925 tons, valued at $3,275,305.

The effect of this improvement has been to greatly reduce freight rates, especially in the marketing season.

It is proposed to apply the available balance, and the amount estimated as a profitable expenditure, for the completion and maintenance of the improvement in accordance with the adopted project.

Further details as to this work are printed in the Annual Report of the Chief of Engineers for 1897, pages 1147–1148. Map is printed in the Annual Report of the Chief of Engineers for 1905, page 1040.

July 1, 1907, balance unexpended	$9,932.20
June 30, 1908, amount expended during fiscal year for maintenance of improvement	270.06
July 1, 1908, balance unexpended	9,662.14
July 1, 1908, amount covered by uncompleted contracts	8,000.00
Amount (estimated) required for completion of existing project	9,975.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *Matawan Creek.*—This creek is a small tidal stream in the eastern part of New Jersey, which discharges into Raritan Bay at Keyport Harbor. It is navigable up to the bridge of the New York and Long Branch Railroad, about 2 miles above its mouth.

In its natural condition the mouth was obstructed by a mud flat, through which a narrow and crooked 3-foot channel existed. Above this flat there was a 4-foot channel for a mile and beyond a narrow 3-foot channel extending nearly up to the head of navigation at Matawan.

The original and existing project for improving this stream, by dredging a 4-foot channel 100 feet wide from the mouth to Winkson Creek, about 1 mile, and thence 75 feet wide to the railroad bridge at Matawan, was adopted March 3, 1881. The cost was estimated at $33,120. Reference to report on examination and survey is noted in the Annual Report of the Chief of Engineers for 1904, page 141.

The amount expended to June 30, 1908, was $50,917.34, of which $21,000 was used in carrying out the project and $29,917.34 for maintenance. About two-thirds of the work proposed under the project has been completed, and a channel has been dredged the required distance with widths of 50 to 100 feet, but this channel has greatly deteriorated.

During the fiscal year under an allotment of $6,000 from the consolidated appropriation, act of March 2, 1907, a contract for dredging for maintenance has been in force. Dredging under this contract was commenced on June 27, 1908, and was in progress at the close of the year at which time 1,258 cubic yards of material had been removed near the mouth of the creek.

The maximum draft that could be carried June 30, 1908, was about 3 feet at mean low water. Mean range of tides, 4.9 feet.

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[a] See consolidated money statement on page 179.

The commerce of this creek is in brick and fireproofing, fertilizer, farm produce, and general merchandise, and amounted to 51.000 tons in 1899, to 60,000 tons in 1901, to 61,500 tons in 1903, to 29,600 tons in 1904, to 58,471 tons in 1905, valued at $203,955; in 1906 to 128,181 tons, valued at $717,505, and in 1907 to 40,900 tons, valued at $163,500.

The effect of this improvement has been to greatly reduce rates of freight, especially in the marketing season.

It is proposed to expend the available balance and the amount estimated as a profitable expenditure for completion and maintenance of the project.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1145. Map is printed in the Annual Report of the Chief of Engineers for 1905, page 1042.

July 1, 1907, balance unexpended	$5,995.60
June 30, 1908, amount expended during fiscal year for maintenance of improvement	108.55
July 1, 1908, balance unexpended	5,887.05
July 1, 1908, outstanding liabilities	768.79
July 1, 1908, balance available	5,118.26
July 1, 1908, amount covered by uncompleted contracts	4,245.20
Amount (estimated) required for completion of existing project	12,120.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*c*) *Raritan River.*—This river is a moderate-sized stream flowing through the central part of the State of New Jersey and emptying into Raritan Bay at Perth Amboy. It is navigable to New Brunswick, N. J., a distance of 12 miles, where it is the eastern terminus of the Delaware and Raritan Canal.

In its natural state the channel to New Brunswick was obstructed by several extensive shoals, on which the depth was from 6½ to 8½ feet at mean low water.

The original and existing project for improvement, adopted June 18, 1878, with subsequent modifications, provided for a channel 200 feet wide and 10 feet deep from the mouth to the Delaware and Raritan Canal terminus at New Brunswick, including a south channel between Crab Island and Kearney's dock, with a length of about 2½ miles, width of 100 feet, and depth of 5½ feet at mean low water, to be obtained by dredging, diking, and rock excavation, the cost being estimated at that time at $2,093,662. Recent and improved methods for doing such work have made it probable that this estimate will not exceed $1,035,000. Reference to reports on surveys with estimates is given in the Annual Report of the Chief of Engineers for 1907, page 166.

The amount expended up to the close of the fiscal year ended June 30, 1908, was $729,390.80, of which $659,192.32 was used in carrying on the work and $46,666.22 for maintaining that already done; of

[a] See consolidated money statement on page 179.

this amount $1.15 was derived from sale of condemned property. About two-thirds of the work contemplated under the project has been completed, and the following work has been accomplished under the project: A channel 10 feet deep has been made from the mouth to the Delaware and Raritan Canal terminus at New Brunswick, the section through and below the reef at Whitehead's dock having a width of 200 feet and the section above the reef a width of 100 feet. South channel has been dredged to the projected depth and width for a length of about 4,000 feet. Five dikes have been built to maintain the channels.

Operations during the fiscal year consisted in dredging under a contract for maintenance which was in force at the beginning of the year. Dredging was commenced on August 5, 1907, suspended September 19, 1907, resumed April 9, and completed on May 15, 1908, and 39,607 cubic yards of material was removed as follows: At the Stakes 16,580, Middle Ground 5,350, and near New Brunswick 17,677 cubic yards. At the close of work the river was open to 10-foot navigation at low water.

It is proposed to apply the amounts recommended as a profitable expenditure to continuing and maintaining the improvement.

On June 30, 1908, the maximum draft that could be carried to the head of navigation was 10 feet at mean low water. Mean range of tides: At mouth of river, 5.1 feet; at New Brunswick, 5.56 feet.

The commerce of this river is principally in coal, ores, refined copper, lumber, building materials, and general merchandise, and amounted in 1901 to 1,266,950 tons, in 1902 to 1,228,791 tons, in 1903 to 1,020,420 tons, in 1905 to 605,197 tons, in 1906 to 736,666 tons, valued at $17,377,645, and in 1907 to 725,690 tons, valued at $32,678,472.

It appears from numerous letters received that this improvement has resulted in a very material reduction of freight rates.

Details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1892, page 881; for 1896, page 780; for 1897, page 1136, and further information is contained in the report for 1900, page 1505.

Maps of the river are printed in Annual Reports of the Chief of Engineers for 1885, page 760, and for 1905, page 1044.

July 1, 1907, balance unexpended	$19,832.81
June 30, 1908, amount expended during fiscal year for maintenance of improvement	18,997.04
July 1, 1908, balance unexpended	835.77
Amount (estimated) required for completion of existing project	373,392.68
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*d*) *South River.*—This is a small stream in the central part of New Jersey, which discharges into the Raritan River about 8 miles above its mouth. Before improvement by the United States a private

[a] See consolidated money statement on page 179.

canal about three-fourths of a mile long had been dredged from near Washington, on the South River, to Sayreville, on the Raritan River, which shortened the sailing course about 2 miles.

The depth in the canal was about 3.5 feet and in the river about 2.5 feet as far as Oldbridge, at the head of navigation, 6.3 miles above the canal.

The first project for this improvement was adopted March 3, 1871, and provided for dredging a channel 6 feet deep at mean low water up to the Washington wharves, at an estimated cost of $13,653. This was completed in 1874, at a cost of $20,000.

The existing project, adopted June 14, 1880, provides for correcting the canal outlet and for obtaining, by dredging and diking, a channel 100 feet wide and 8 feet deep to Washington, 1.5 miles above the mouth; thence 6 feet deep to Bissetts, 3.7 miles above the mouth; thence 4 feet deep to Oldbridge, 6.3 miles above the mouth, at the head of navigation. The cost was estimated at $194,695, but was reduced in 1892 to $176,695. References to examinations and surveys are contained in the Annual Reports of the Chief of Engineers for 1904, page 143, and for 1907, pages 166 and 175.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1908, was $115,427.72, of which $89,336 was used in carrying on the work and $26,091.72 for maintenance. About one-half of the work contemplated under the project has been completed. Below the wharves at the village of South River or Washington a channel from 50 to 75 feet wide and 8 feet deep has been dredged and the projected dikes have been built. Above Washington the improvement accomplished is shown in report of work for fiscal year.

During the past fiscal year the work done consisted in dredging for maintenance and continuing improvement; 46,477 cubic yards of material was removed, and the work accomplished consisted in completing the channel between the highway bridge and the Raritan River railroad bridge, a distance of 2,350 feet, and extending it 4,140 feet to within 340 feet of Bissetts, with width of from 100 to 50 feet.

The maximum draft that could be carried to South River or Washington on June 30, 1908, was about 7 feet, thence to within 340 feet of Bissetts 6 feet at mean low water. Mean range of tides: At canal, 5.34 feet; at Oldbridge, 4.57 feet.

Large brickyards established along the banks of the river give it a commercial importance out of proportion to its size.

The commerce is principally in brick, sand, clay, coal, fertilizer, and general merchandise, and amounted in 1899 to 343,202 tons, in 1901 to 328,186 tons, in 1902 to 387,246 tons, in 1903 to 333,890 tons, in 1904 to 392,626 tons, in 1905 to 260,204 tons, valued at $1,046,208; in 1906 to 226,227 tons, valued at $972,550; and in 1907 to 118,549 tons, valued at $477,530.

The improvement has caused a great reduction in freight rates, and it appears probable that the rates will be further reduced when the improvement reaches the upper stretches of the river. From reliable information received it appears that as a result of this improvement a reduction in freight rates on fire brick by rail to Boston of from $3.25 to $2 per ton has been made. The freight rate by rail to New York is $1.60 per ton; by water it is 75 cents per ton.

It is proposed to apply amount estimated as a profitable expenditure and the available balance to continuing and maintaining the improvement in accordance with the adopted project.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1896, pages 784–785.

Reference to preliminary examination and plan and estimate of cost of improvement of Old South River, as contained in reports dated January 27 and December 6, 1906, printed in House Document No. 335, Fifty-ninth Congress, second session, may be found in Annual Report of the Chief of Engineers for 1907, page 175.

Sketches of South River are printed in the Annual Reports of the Chief of Engineers for 1882, page 678; 1885, page 764, and 1905, page 1046.

July 1, 1907, balance unexpended		$17,754.96
Received from sale of map during the year		1.00
		17,755.96
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$11,336.00	
For maintenance of improvement	5,668.05	
		17,004.05
July 1, 1908, balance unexpended		751.91
Amount (estimated) required for completion of existing project		87,359.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

(*e*) *Elizabeth River.*—This is a small stream in the eastern part of New Jersey which discharges into the Arthur Kill at Elizabethport. Before improvement by the United States its width varied from 50 to 90 feet, and it had a high-water depth of 4 feet at the head of navigation at Broad street, Elizabeth, about 2¾ miles above its mouth.

The original and existing project, approved March 3, 1879, consists in dredging a channel 60 feet wide and 7 feet deep at mean high water, at an estimated cost, revised in 1881, of $43,160.

The amount expended on this work to June 30, 1908, was $51,533.84, of which $27,000 was used for carrying out the project and $24,533.84 for maintenance. About two-thirds of the work contemplated under this project has been completed. A channel 7 feet deep at mean high water and from 30 to 60 feet wide has been dredged from the mouth to Bridge street, Elizabeth.

Operations during the fiscal year consisted in dredging under contract for maintenance of channel between South and Summer streets, Elizabeth.

The maximum draft that could be carried to Bridge street, Elizabeth, about one-fourth mile from the head of navigation at Broad street, on June 30, 1908, was about 4 feet at mean high water. Mean range of tides: At mouth, 4.7 feet; at Bridge street, Elizabeth, 3.4 feet.

Under existing conditions stated in the district officer's report, no further appropriation is recommended.

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[a] See consolidated money statement on page 179.

The commerce of the river is in coal, building materials, and miscellaneous freights. It amounted to 21,650 tons in 1895, to 28,865 tons in 1897, to 29,495 tons in 1901, to 40,250 tons in 1902, to 37,136 tons in 1903, to 36,336 tons in 1904, to 28,887 tons in 1905, valued at $247,717; in 1906 to 43,255 tons, valued at $352,784, and in 1907 to 20,053 tons, valued at $87,322.

It appears from statements received from shippers that there has been a reduction in freight rates, probably due to this improvement.

References to reports on examinations and surveys are noted in Annual Report of the Chief of Engineers for 1904, page 143.

Details in reference to this improvement may be found in the Annual Reports of the Chief of Engineers for 1896, page 778, and 1897, pages 1134 and 1185. Map is printed in the Annual Report of the Chief of Engineers for 1905, page 1048.

July 1, 1907, balance unexpended	$9,993.20
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,582.59
July 1, 1908, balance unexpended	8,410.61
July 1, 1908, outstanding liabilities	3,046.90
July 1, 1908, balance available	5,363.71
July 1, 1908, amount covered by uncompleted contracts	4,180.02
Amount (estimated) required for completion of existing project	16,160.00

(*f*) *Shoal Harbor and Compton Creek.*—This harbor is on the south shore of Raritan Bay, 5 miles from Sandy Hook. Compton Creek is a narrow stream emptying into it. The natural harbor is inside the mouth of the creek, where the depth is from 3 to 6 feet at mean low tide. The creek is navigable for about 1 mile above its mouth, where it is crossed by a railroad bridge without a draw. One-fourth of a mile above its mouth it is crossed by a highway drawbridge.

The entrance to this harbor was originally obstructed by a broad flat shoal on which there was a depth of less than 1 foot at mean low tide, the distance between the deep water in the creek and the 4-foot depth in the bay being about one-half mile.

The original and existing project, adopted September 19, 1890, proposes a channel 4 feet deep connecting Compton Creek with Raritan Bay, the width to be 150 feet in the bay and 75 feet in and near the mouth of the creek, the channel through Shoal Harbor to be protected by a dike if necessary, at an estimated cost of $64,130.

The amount expended to June 30, 1908, was $45,500.93, of which sum $17,000 was applied to carrying out the project and $28,500.93 for maintenance. About three-fifths of the dredging contemplated under this project has been completed and a 4-foot channel 75 feet wide has been dredged through Shoal Harbor, connecting Raritan Bay with Compton Creek.

During the fiscal year dredging for restoration was in progress under contract. Work was commenced on July 19 and completed on October 24, 1907. The amount of material removed was 13,064 cubic yards, and the projected depth restored in the mouth of the creek and the head of the harbor for a combined length of 2,400 feet. Under existing conditions, as stated in the district officer's report, no further appropriation is recommended.

The maximum draft that could be carried June 30, 1908, in the improved channel through Shoal Harbor and Compton Creek to the drawbridge was 4 to 5 feet at mean low water. Mean range of tides, 4.5 feet.

The commerce of this locality in farm and fish products, fertilizers, and general merchandise amounted to 180,000 tons in 1901, to 48,790 tons in 1902, to 65,175 tons in 1903, to 28,570 tons in 1904, to 34,340 tons in 1905, valued at $1,198,200; in 1906 to 34,538 tons, valued at $1,167,920, and in 1907 to 62,895 tons, valued at $1,809,380.

It appears from statements received from shippers that there has been a reduction on coal freights of 40 per cent, on manure from 40 to 50 per cent, and on fish 20 per cent, as a result of this improvement, and if the improvement is not continued the rates would be very much advanced.

Reference to report of examination and survey is noted in the Annual Report of the Chief of Engineers for 1907, page 169.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1150. Map is printed in the Annual Report of the Chief of Engineers for 1905, page 1050.

July 1, 1907, balance unexpended	$9,993.20
June 30, 1908, amount expended during fiscal year for maintenance of improvement	8,743.56
July 1, 1908, balance unexpended	1,249.64
Amount (estimated) required for completion of existing project	47,130.00

(*q*) *Cheesequake Creek.*—This is a small stream in the eastern part of New Jersey which discharges into Raritan Bay, about 2 miles east of South Amboy. Before improvement by the United States the available navigable depth in the creek was 1½ feet at mean low water over the shoals, the distance from the entrance to the upper limit of navigation being 3½ miles.

The existing project was adopted June 14, 1880, and provided for a new outlet, 5 feet deep, from the creek into Raritan Bay, at right angles to the shore line through a beach which put across the mouth of the creek from the right bank, and which had forced the outlet nearly one-half mile to the westward. This was to be obtained by dredging and constructing parallel jetties of stone, 200 feet apart, on each side of the dredged channel; the old outlet was to be closed by a pile dike, and a channel, 4 feet deep and from 50 to 100 feet wide, was to be dredged from the mouth to the head of navigation, 3½ miles up the creek. In this distance two dikes were to be built, and a new channel to be made through the marsh was to cut off a bend in the creek. Stump Creek, a tributary stream emptying into the creek near its mouth, was to be improved by dredging a channel 50 feet wide and 3 feet deep.

The cost was estimated at $75,279, which was revised in 1885 to $90,000.

Reference to survey and estimate are noted in the Annual Report of the Chief of Engineers for 1905, page 152.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1908, was $49,352.28, of which $40,000 was used in carrying out the project and $9,352.28 in maintenance. About four-ninths of the work contemplated under this project has been completed, and the work accomplished consists of the construc-

tion of the two parallel stone jetties at the mouth, the dredging of a 5-foot channel between them connecting the creek with the 5-foot curve in Raritan Bay, and the construction of the pile dike closing the old outlet.

Operations during the fiscal year consisted in dredging under contract for maintenance of the entrance channel from Raritan Bay to the highway bridge. Work was commenced on July 17 and completed August 21, 1907, and the amount of material dredged was 8,236 cubic yards; 5 feet depth was restored in the channel.

The improvement has not advanced sufficiently to affect freight rates. It is proposed to expend the amount estimated as a profitable expenditure in maintenance.

The maximum draft that could be carried through the mouth of the creek on June 30, 1908, was about 5 feet. Mean range of tides, 5.1 feet.

The commerce of the creek is principally in fertilizer, sand, brick, clay, and farm produce, and amounted in 1886 to about 50,000 tons, in 1905 to 45,500 tons, valued at $146,050; in 1906 to 83,648 tons, valued at $625,000, and in 1907 to 89,500 tons, valued at $263,100.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1886, page 763.

Sketches of Cheesequake Creek are printed in the Annual Reports of the Chief of Engineers for 1882, page 680, and in 1905, page 1051.

July 1, 1907, balance unexpended	$3,996.10
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,996.10
Amount (estimated) required for completion of existing project	50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

CONSOLIDATED.

July 1, 1907, balance unexpended		$77,498.07
Received from sale of map during the year		1.00
		77,499.07
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$11,336.00	
For maintenance of improvement	39,365.95	
		50,701.95
July 1, 1908, balance unexpended		26,797.12
July 1, 1908, outstanding liabilities		3,815.69
July 1, 1908, balance available		22,981.43
July 1, 1908, amount covered by uncompleted contracts		16,425.22
Amount (estimated) required for completion of existing project		596,136.68
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		158,095.00

(See Appendix G 5.)

[a] See consolidated money statement on this page.

ing an area of about 5 square miles, and known, respectively, as the North Branch (or Navesink River) and the South Branch, and a channel called the main stem, which unites the two branches at their eastern ends and extends northwardly to the outlet at southeast end of Sandy Hook Bay. The river is navigable on the North Branch to Red Bank, 8 miles from the mouth, where it is crossed by three bridges without draws, and on the South Branch to Branchport, 9 miles from the mouth; also to Little Silver, Oceanport, Parkers Creek, North Long Branch, and Monmouth Beach, on the several arms of the South Branch.

The part of the river which has been under improvement by the United States consists of the main stem, the North Branch to Oceanic, 5 miles from the mouth, and the South Branch to the vicinity of Seabright, about 5⅓ miles from the mouth. The bays above Oceanic and Seabright had sufficient water to accommodate navigation.

Before any improvement was begun by the United States the available depth to Oceanic, on the North Branch, was 3½ feet, and to Seabright, on the South Branch, it was 2½ feet; the depth in the main stem was 4 feet. For details see Annual Report of the Chief of Engineers for 1886, page 756.

By act of Congress of August 30, 1852, $1,500 was appropriated for and expended upon a survey to ascertain the extent of a break through the beach between the Shrewsbury River and the ocean, but no work of improvement was begun.

First project: By act of Congress of July 11, 1870, a survey of the river was ordered. The report on this survey described a bar across the river nearly opposite the Navesink lights and four smaller bars above, and recommended deepening them by dredging, at an estimated cost of $14,000. The work was completed under appropriations amounting to $19,000, made in 1871 and 1873, and a new shoal near Lower Rocky Point was also dredged. The dredged channels did not long maintain the improved depth (6 feet at low tide).

Existing project, with modifications: The river and harbor act of 1875 provided for a survey of the "North and South branches of the Shrewsbury River, New Jersey." The project provided for dredging at Upper and Lower Rocky Point and a training dike at the entrance to the North Branch, at a total estimated cost of $18,000. This sum was appropriated by the river and harbor act of 1878, but before beginning the work it was decided to make a new and more detailed survey of the river. This survey was made in 1878, and the report presented a plan for improving both branches of the river and main stem to obtain a channel of 6 feet depth at mean low water, with a width of 300 feet in the main stem and of 150 feet in each of the branches, by dredging and constructing pile dikes or training walls. At this time the available depth in the main stem was found to be 5.4 feet at mean low water, in the North Branch 3.5 feet, and in the South Branch, at the entrance, 2.6 feet, practically suspending all navigation in the latter channel. The plan was referred to a Board of Engineers, and with slight modifications was approved by it February 12, 1879. It provided for the construction of seven pile dikes and for dredging at seven different shoal points, at a total estimated cost of $142,086. This project was adopted March 3, 1879, when an

appropriation of $10,000 was made for beginning work. No essential modification of this project has since been made. Nine dikes have been built and the shoals have been dredged and redredged frequently in order to maintain the proposed depth of 6 feet. Owing to the change in diking and to the cost of dredging being generally greater than originally estimated, it was found necessary in 1881, 1883, and 1887 to add to the estimate for the completion of the whole work. The existing project for improvement, therefore, is the project of 1879, with the modifications indicated above, and proposes to secure a channel of 6 feet depth at mean low water, with width of 300 feet up to the junction of the North and South branches and with a width of 150 feet in those branches, by means of dredging and diking, at an estimated cost (including appropriation of 1878 applied to this project) of $234,062.

The sum expended under the existing project to the close of the fiscal year ending June 30, 1908, was $344,068.54, of which $195,393.95 was for carrying out the project, $143,674.59 for maintenance, and $5,000 for the survey made in 1903. The project is completed, dredging, and dike repairs being required for maintenance of channels. Operations during the fiscal year consisted in dredging for maintenance.

The maximum draft that could be carried June 30, 1908, throughout the limits of the improvement was 6 feet at mean low water in channels not less than 50 feet in width. Mean range of tides: Outer bar, 5 feet; Highlands bridge, 3 feet; Seabright bridge, 1.3 feet.

The commerce of this river, mainly in coal, farm products, fertilizer, and general merchandise, amounted in 1889 to 906,000 tons; in 1902 to 657,000 tons; in 1903 to 761,000 tons; in 1904 to 780,290 tons; in 1905 to 1,768,500 tons, valued at $8,215,000; in 1906 to 1,668,500 tons, valued at $7,235,000, and in 1907 to 1,718,125 tons, valued at $6,629,750. The passenger traffic is important, the number of people carried by the Patten Line, South Branch, in 1902 being 264,635; in 1903, 277,257; in 1904, 266,157, and in 1905, 310,367.

It is proposed to apply the amount recommended as a profitable expenditure to maintenance of the improvement in accordance with the project.

It appears from reports received from the Merchants Steamboat Company, and the New York and Long Branch Steamboat Company, that freight rates have been lowered, and maintained, as results of the improvement by the United States; also that the commerce has increased, and that the improvement tends to keep the freight rates down.

Further details in reference to this work may be found in the Annual Reports of the Chief of Engineers for 1896, page 797, and 1900, page 185.

Report upon survey of 1852 was made in October, 1853, and references to further examinations and surveys may be found in the Annual Report of the Chief of Engineers for 1904, pages 145–146.

Sketches of Shrewsbury River are printed in the Annual Reports of the Chief of Engineers for 1879, 1881, 1882, 1887, 1890, 1891, 1892, and 1893, and maps of the whole river are printed in House Document No. 123, Fifty-eighth Congress, second session, and in Annual Report of the Chief of Engineers for 1895, page 1054.

July 1, 1907, balance unexpended	$22,981.45
Received from sale of map during the year	1.25
	22,982.70
June 30, 1908, amount expended during fiscal year for maintenance of improvement	8,049.99
July 1, 1908, balance unexpended	14,932.71
July 1, 1908, outstanding liabilities	2,202.68
July 1, 1908, balance available	12,730.03
July 1, 1908, amount covered by uncompleted contracts	10,198.72
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	20,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix G 6.)

7. *Manasquan River, New Jersey.*—This is a small stream in the eastern part of New Jersey which empties into the Atlantic Ocean about 26 miles south of Sandy Hook; in its natural condition the low-water depth for several miles above the mouth varied from 4 to 6 feet. The outlet, however, was obstructed by a shifting sand bar, on which the depth did not exceed 1½ feet. After severe storms this outlet was sometimes entirely closed, remaining so until sufficient fresh water had accumulated in the river above to force an outlet into the ocean.

A project for its improvement, adopted by the river and harbor act of March 3, 1879, based on examination and survey as printed in Annual Report of the Chief of Engineers for 1879, pages 463–466, contemplated obtaining a permanent outlet for the river nearly at right angles to the shore, with a depth of 6 feet at mean low water; also dredging a channel in the lower river to the same depth. The estimated cost was $52,120. Work was suspended in 1883, after three appropriations, amounting to $39,000, had been expended on the improvement in the construction of two training dikes 1,515 and 475 feet long, respectively.

The existing project, approved March 3, 1899, with subsequent modifications, which is a modification of the original project, contemplates obtaining an outlet 6 feet deep for the river, and also in deepening the channel just above the mouth to the same depth, at an additional cost of $18,300 over the amount expended and on hand, making the total estimated cost of the improvement $59,300, to which should be added $1,075 expended for maintenance. References to examinations and surveys are noted in the Annual Report of the Chief of Engineers for 1904, page 147.

The amount expended to June 30, 1908, was $41,038.08, of which $39,000 was used for carrying out the project and $2,038.08 for maintenance.

This improvement, under present project, is about half completed.

During the past fiscal year no work was done on this improvement.

No further appropriation is recommended at this time, for reasons stated in the district officer's report.

The maximum draft that could be carried June 30, 1908, was about 2 feet at mean low water. Mean range of tides, 2.4 feet.

The commerce of the inlet amounts to practically nothing. The river is used principally by small fishing craft; also by pleasure boats during the summer season.

The improvement has not advanced to a condition which would affect the rates of freight. It is stated that there will be a reduction when the entrance is made navigable.

It is proposed to apply the available balance to the maintenance of the improvement.

Detailed descriptions of this improvement and histories of the work and maps are printed in the Annual Reports of the Chief of Engineers for 1880, Part 1, pages 547-556; 1882, Part 1, page 701; 1898, page 1070, and 1905, page 1056.

July 1, 1907, balance unexpended	$4,976.64
June 30, 1908, amount expended during fiscal year for maintenance of improvement	14.72
July 1, 1908, balance unexpended	4,961.92
Amount (estimated) required for completion of existing project	14,375.00

(See Appendix G 7.)

8. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Wreck of wooden hulk in Raritan Bay, near Lorillard, N. J.*—This wreck was reported in July, 1906, and was found to be a sunken hulk, just awash at low tide and a menace to navigation. The wreck was partially blown to pieces, but not wholly removed, the complete removal not having been required. Settlement with Jesse A. Gray, who had charge of the work of removal, was made on the basis of fair value for the work actually done. The total amount expended was $597.77.

(*b*) *Wreck of canal boat Thomas Walker in the Raritan River, New Jersey.*—This wreck was sunk in the Raritan River at the dock of the Bloomfield Clay Company. The removal under contract was completed on December 24, 1907, at a cost of $900.

(*c*) *Wreck of schooner Crystal in Kill van Kull, off Constable Point, N. J.*—This wreck was first reported in November, 1907, and was found sunk off pier 5 of the Standard Oil Company, Constable Point, N. J. The removal, under emergency, was completed on December 3, 1907, at a cost of $479.

(See Appendix G 8.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress, and printed in documents as indicated:

1. Preliminary examination of Rahway River, New Jersey.—Report dated August 20, 1907, is printed in House Document No. 350, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. Preliminary examination of Arthur Kill, westerly side of Buckwheat Island, New Jersey, with a view to deepening the channel.—Report dated July 18, 1907, is printed in House Document No. 533, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

IMPROVEMENT OF RIVERS AND HARBORS IN THE PHILADELPHIA, PENNSYLVANIA, DISTRICT.

This district was in the charge of Maj. J. C. Sanford, Corps of Engineers, to May 5, 1908, and in the temporary charge of Maj. Herbert Deakyne, Corps of Engineers, since that date. Division engineer, Col. D. W. Lockwood, Corps of Engineers.

1. Delaware River, New Jersey and Pennsylvania.—Trenton, the head of natural and actual navigation of the Delaware River, is about 30 miles above the upper end of the port of Philadelphia. In its original condition this stretch of river was obstructed by several shoals. Between Bordentown and Trenton, a distance of about 5 miles, a narrow and circuitous channel existed which carried only from 3 to 6 feet at mean low water. At Kinkora bar, about 9 miles below Trenton, there was a shoal carrying 7½ feet, and at Fivemile bar, opposite the upper part of Philadelphia, a shoal crossed the Pennsylvania channel, carrying only 3 to 4 feet at mean low water. There was, however, a depth of 13 feet past Fivemile bar in the New Jersey channel south of Petty Island.

Below Philadelphia the river in its original condition presented obstructions at Mifflin bar which reduced the depth at mean low water to 17 feet, at Schooner ledge and Cherry Island flats to 18 feet, at Bulkhead shoal and Baker shoal to about 20 feet, and at Duck Creek flats to about 20 feet. The lower end of Duck Creek flats is 56 miles below Philadelphia.

In that part of the Delaware River between Trenton, N. J., and Bridesburg, Pa., efforts in the past have been directed toward relieving commerce from the obstructions which exist in the upper 9 miles of the river and toward deepening the channels across Perriwig and Kinkora bars.

Previous to 1885 the efforts to improve the river between Philadelphia and the bay were confined to dredging, except at Schooner ledge, where solid rock was removed. The work was done under appropriations for special localities, and also under general appropriations for the Delaware River below Bridesburg.

A Board of Engineers, convened by direction of the Secretary of War for the purpose of considering the subject of the permanent improvement of Delaware River and Bay, recommended, in a project dated January 23, 1885, and adopted in that year, the formation of a ship channel from a point opposite Philadelphia and about midway between the American Ship Building Company's yard and the Gas Trust wharf to deep water in Delaware Bay, having a least depth of 600 feet and a depth of 26 feet at mean low water. The

formation of such a channel was to be obtained, except at Schooner ledge, where rock would have to be removed, by regulating the tidal flow by means of dikes, with recourse to dredging where necessary, as an aid to such contracting and regulating works. The estimated cost of obtaining a channel of the above dimensions was about $2,425,000, which covered the estimated cost of the permanent improvement of the Delaware River between the upper part of Philadelphia and deep water in the bay. The annual cost of maintenance was estimated at 10 per cent of the original cost for dredging and 1 per cent of the original cost for dikes. This estimate of cost did not include the improvement of Philadelphia Harbor, which was a separate project.

With appropriations aggregating $3,935,000 there was completed between 1888 and 1898 a project for improving the harbor between Philadelphia, Pa., and Camden, N. J., which provided a channel depth of 26 feet at mean low water from Christian street, Philadelphia (Kaighn Point, N. J.), up to the Pennsylvania Railroad bridge at Fishers Point, N. J. In 1906 an allotment of $10,000 was made for redredging shoal places within the limits of this improvement, from the emergency appropriation contained in the river and harbor act approved March 3, 1905. Final report on the completion of this project is printed in the Annual Report of the Chief of Engineers for 1899, page 1330, and an account of the work done under the emergency allotment in the Report for 1907, page 1100.

In the river and harbor act approved March 3, 1899, Congress adopted a new project for the improvement of the river, providing for the formation of a channel 600 feet wide and 30 feet deep from Christian street, Philadelphia, to deep water in Delaware Bay, at an estimated cost of $5,810,000. This project superseded the project of 1885. At the time of adoption of the new project the 26-foot channel, with widths varying from 200 to 600 feet, had been formed from the upper part of Philadelphia Harbor to the bay, except at the following-named localities: Tinicum Island shoal, depth from 23.6 feet to 26 feet over a distance of about 4,200 feet; above Schooner ledge, depth from 24 feet to 26 feet over a distance of about 4,800 feet; from below Marcushook to Bellevue, depth from 23 to 26 feet over a distance of about 13,500 feet. These distances are measured on the range lines. The distances measured between the 26-foot curves on the lines of deepest water were much shorter.

Part of the 26-foot channel above Marcushook, Pa., was dredged by the city of Philadelphia under the supervision of this office, with money appropriated by the city of Philadelphia.

At the same time there was between Trenton and Philadelphia a channel 6 feet deep at mean low water through Perriwig bar, a depth of 7 feet in the eastern channel at Bordentown, a channel 8½ feet deep through Kinkora bar, and a channel 26 feet deep over the whole width through Fivemile bar.

The total amount expended on the 26-foot project since its adoption, in 1885, was $1,532,688.81, of which about $200,000 is estimated to have been applied to maintenance. In addition to this expenditure the following sums were expended since the adoption of the 26-foot channel, in 1885, on special localities on the river under appropriations made for the purpose:

Channel across Smiths Island bar, between Philadelphia, Pa., and Camden, N. J	$30,000.00
Between the upper part of Philadelphia, Pa., and Trenton, N. J	37,500.00
Rebuilding and enlarging dike at junction of Schuylkill and Delaware rivers	3,000.00
Removing rock ledge opposite Petty Island	69,463.26
Expenses of Board of Engineer officers on project for channel 30 feet deep and 600 feet wide	7,000.00
Total	146,963.26

The entire amount expended on the improvement of the Delaware River from 1836 to June 30, 1908, under appropriations for special localities and the general river improvement, not including Philadelphia Harbor, was $8,582,955.29, of which $174,115.75 was expended on the part of the river between Trenton and Philadelphia and $8,710.17 for maintenance.

Work under the existing project below Christian street was commenced under an appropriation of $300,000 contained in the river and harbor act of March 3, 1899, and has been prosecuted under this and subsequent acts. Under the provisions of this act $69,463.26 was applied to the improvement of the river between Trenton and Christian street, $7,000 to the expenses of the Board of Engineer officers on project for a 30-foot channel, and the balance, $223,536.74, under the existing project.

The river and harbor act approved March 2, 1907, appropriated the sum of $895,000 for completing this improvement and authorized the letting of contracts to the extent of $500,000 additional for maintenance of the dredged channel, this amount to be available, however, for use in completion of the project. Of this appropriation the sum of $40,000 is to be applied to maintenance of the dredged waterway in Philadelphia Harbor above Christian street, Philadelphia. Of the sum of $500,000 authorized by the river and harbor act of March 2, 1907, $375,000 was appropriated in the sundry civil act approved May 27, 1908, leaving $125,000 yet to be appropriated under the authorization.

Up to the close of the fiscal year ending June 30, 1908, the sum of $5,551,303.22 was expended on the work of the existing project in surveys, in dredging at Duck Creek flats, Baker shoal, Salem Cove flats, Deep Water Point, Cherry Island flats, Schooner ledge rock area, Tinicum and Mifflin bar shoals, and in the construction of bulkheads for the reception of dredged material and to act as training walls to direct the currents.

At Baker shoal the work of bulkhead construction has resulted in the completion of 30,627 linear feet of structure. At Cherry Island flats the work of bulkhead construction has resulted in the completion of 4,535 linear feet of structure. The work of dredging under the 30-foot project resulted in the formation of a channel 30 feet deep at mean low water, about 20,500 feet long, and with an average width of 600 feet through the upper part of Baker shoal; a channel of the same depth, with length of 43,000 feet, and 600 feet in width through Duck Creek flats shoal; a channel of the same depth and 600 feet in width for a distance of 12,500 feet through Salem Cove flats shoal; a channel of the same depth and 600 feet in width for a distance of 25,500 feet through Cherry Island flats shoal; a channel of the same depth

and varying in width from 280 to 600 feet in section 3, subsections A and B, and section 5, subsections A and B, to the south line of Pennsylvania.

The work of rock removal at Schooner ledge is now about 90 per cent completed.

The greatest draft of water that could be carried at mean low water on June 30, 1908, over the shoalest part of the river below Philadelphia, was about 22.8 feet on center line of channel on Liston lighthouse range, below Listons Point, Delaware. The material in the channel at this locality is very soft mud.

It is proposed to apply the available and authorized funds to completion of the project and maintenance of the dredged channel. This will include widening of the channel beyond 600 feet at the bends below Philadelphia, as well as dredging in subsections 3 A, 3 B, 5 A, and 5 B to obtain the project width, completion of rock removal at Schooner ledge, and surveys, engineering and office expenses under the general project, the work to be done by contract or by hired labor and Government plant, as may be to the best interests of the United States.

The additional funds asked for will be applied to maintenance of the channel from Delaware Bay to the upper limits of the harbor of Philadelphia at the railroad bridge near Fishers Point.

In 1905 the State of Pennsylvania and the city of Philadelphia appropriated sums aggregating $750,000 to be expended in accordance with the general project on that part of the river between the south line of Pennsylvania and the city of Philadelphia. This money is to be expended by the city of Philadelphia, and the work to be done is to be under the supervision of the United States engineer officer in charge of the improvement.

Under date of July 27, 1906, the United States entered into an agreement with the city of Philadelphia whereby Government plant should be placed on the work in sections 7 and 8 and operated under the direction of this office; all cost of the work to be paid by the city of Philadelphia. The city further entered into a contract with the American Dredging Company, under date of October 27, 1906, for the dredging of the entire channel to full width and depth in sections 6 A, 6 B, and 9 for a lump sum in each case.

Work under the above agreement with Government plant in sections 7 and 8 has resulted in a channel through Tinicum Island flats 30 feet deep and from 400 to 600 feet in width, and a channel through Mifflin Bar shoal 30 feet deep and 600 feet wide.

The contract dredging has resulted in a channel 30 feet deep and 600 feet wide through section 6, subsections A and B, and through section 9, to Christian street, Philadelphia.

For 1890 the total foreign freight movement of the Delaware River was estimated at 2,923,994 tons and the total domestic freight movement at 8,433,276 tons; total, 11,356,270 tons. For 1907 the total foreign freight movement was estimated at 5,857,236 tons and the total domestic freight movement at 21,426,293 tons; total, 27,283,529 tons.

The deepening of the channel below Philadelphia increases the number of deep-draft vessels trading with foreign ports. The establishment of existing lines has resulted in lower import and export

rates. The maintenance of a deep channel from Philadelphia to the sea also affects the rates at other ports by keeping up the competition between them and this port. No exact figures can be given which will show the amount that freight rates have been lowered by the improvement.

COMMERCIAL STATISTICS.

The following statement concerning the foreign commerce of the Delaware River for the years ending December 31, 1906 and 1907, is compiled from the reports of the Board of Trade of the city of Philadelphia:

Articles.	1906.	1907.
IMPORTS.	*Tons.*	*Tons.*
Drugs and chemicals	213,206	144,717
Hemp, jute, flax, and their fabrics	31,295	36,257
Iron, manufactured	68,333	81,396
Iron ore	377,241	600,598
Sugar	255,057	200,370
Miscellaneous	787,808	787,182
Total	1,732,935	1,800,520
EXPORTS.		
Coal	642,249	930,599
Grain and flour	343,019	581,013
Petroleum and products	1,209,642	1,124,673
Miscellaneous	1,606,085	1,420,431
Total	3,800,995	4,056,716

The following statement concerning the domestic and coastwise commerce of the Delaware River for the years ending December 31, 1906 and 1907, has been compiled from returns made by shippers, consignees, and carriers:

Articles.	1906.		1907.	
	Tons.	Value.	Tons.	Value.
ARRIVALS.				
Chemicals	164,818	$3,794,174	312,560	$4,825,498
Coal	617,089	2,236,895	715,498	2,553,793
Lumber	857,713	13,652,523	961,347	10,588,854
Sand	2,052,441	1,338,378	2,345,398	1,283,131
Miscellaneous	4,656,566	670,781,019	4,827,537	781,240,860
Total	8,348,627	691,802,989	9,162,335	800,492,136
DEPARTURES.				
Chemicals	79,644	2,191,711	119,335	2,344,170
Coal	7,730,543	27,206,621	7,877,432	30,764,762
Fertilizers	110,931	2,335,920	114,736	2,303,720
Iron, manufactured	76,239	2,549,832	20,096	485,198
Miscellaneous	4,231,133	586,039,298	4,132,309	573,344,187
Total	12,228,490	620,323,382	12,263,958	609,242,037

July 1, 1907, balance unexpended		[a] $1,033,273.82
June 30, 1908, credited to appropriation during fiscal year: Sales of blueprints, $21.99; account services U. S. dredge *Delaware* in New York Harbor, $9,716.05; property transferred to appropriation for improving harbor at Key West, Fla., $20.62		9,758.66
Amount appropriated by sundry civil act approved May 27, 1908		375,000.00
		[a] 1,418,032.48
June 30, 1908, amount expended during fiscal year for works of improvement	$617,546.28	
To be restored to appropriation on account of payments made for Quartermaster's Department, $2,601.08; Isthmian Canal Commission, $192.61	2,793.69	
		614,752.59
July 1, 1908, balance unexpended		[a] 803,279.89
July 1, 1908, outstanding liabilities		[a] 131,001.60
July 1, 1908, balance available		672,278.29
July 1, 1908, amount covered by uncompleted contracts		198,819.54
Amount (estimated) required for completion of existing project		125,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[b] 390,000.00

(See Appendix H 1.)

2. Perriwig bar, Delaware River.—The project for this improvement was adopted March 2, 1907, and provides for dredging a channel 7 feet deep at mean low water with a bottom width of 200 feet, in three straight stretches through Perriwig bar, between Trenton and Bordentown, at estimated cost of $50,000. This sum was appropriated in the river and harbor act of March 2, 1907, for completing the improvement.

The plan of proposed improvement is printed in House Document No. 852, Fifty-ninth Congress, first session.

During the fiscal year ending June 30, 1907, the sum of $530.29 was expended in a survey of the locality and other preliminary work with the view to a contract for the work to be done.

During the past fiscal year the sum of $48,829.37 was expended in dredging a channel under the project. The work has resulted in the formation of a channel through the bar 7 feet deep at mean low water, about 6,000 feet long and with a bottom width of 200 feet.

This improvement has enabled the steamship companies to continue their service and maintain the present low freight rates between Philadelphia and Trenton. Otherwise these steamers would necessarily have been withdrawn and the only means of communica-

[a] This amount includes a balance of $15.67 remaining from an allotment of $10,000 for Philadelphia Harbor, from the emergency appropriation made in the river and harbor act of March 3, 1905.

[b] Of this amount $125,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907, and $265,000 for work of maintenance, including Philadelphia Harbor above Christian street.

tion between the two cities would have been by railroad, on which the freight rates are much higher than by water.

July 1, 1907, balance unexpended	$49,469.71
June 30, 1908, amount expended during fiscal year for works of improvement	48,829.37
July 1, 1908, balance unexpended	640.34
July 1, 1908, outstanding liabilities	168.33
July 1, 1908, balance available	472.01
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	1,500.00

(See Appendix H 2.)

3. Bordentown bar, Delaware River.—Under date of April 20, 1908, an allotment of $500 was made by the Secretary of War from the emergency appropriation of $300,000, carried by the river and harbor act approved March 2, 1907, for a survey to determine the work necessary to restore the channel for navigation.

An additional allotment of $9,500 was made from the same appropriation under date of June 8, 1908, for dredging under the project.

The project provides for a channel 7 feet deep at mean low water, with a bottom width of 200 feet, or as near that width as the funds will permit, in two straight reaches through Bordentown bar.

During the past fiscal year the sum of $256.09 was expended in a survey of the locality, and dredging under an emergency contract was begun. About 60 per cent of the work was completed at the end of the year.

Amounts allotted from appropriation for emergencies in river and harbor works, act of March 2, 1907:	
April 20, 1908, for survey	$500.00
June 8, 1908, for restoration of channel	9,500.00
	10,000.00
June 30, 1908, amount expended during fiscal year for survey work	256.09
July 1, 1908, balance unexpended	9,743.91
July 1, 1908, outstanding liabilities	285.53
July 1, 1908, balance available	9,458.38
July 1, 1908, amount covered by uncompleted contracts	9,000.00

(See Appendix H 3.)

4. Ice harbor at Marcushook, Pa.—In 1785 the Commonwealth of Pennsylvania built two wharves upon crib piers at Marcushook for the convenience of commerce. In 1829 an appropriation was made by Congress for repairing the piers and improving the harbor.

In 1866 a project was adopted for a harbor in Delaware River to protect vessels against moving ice. The old work at Marcushook was utilized as far as possible. The amount expended from 1866 to June 30, 1908, was $213,962.46. Since 1899 all expenditures have been for repairs and maintenance. The last amount appropriated for the work was $5,000, by act of September 19, 1890.

The harbor covers an area of 12 acres, of which about one-half has a depth of 12 to 18 feet and the other half 18 to 25 feet at mean low

water. The protection consists of the old landing piers and seven detached piers, having foundations of wooden cribs filled with stone, the superstructures being faced with cut stone. The detached piers are in need of minor repairs.

During the past fiscal year no work was in progress.

Rules for the use of the landing piers were approved by the Acting Secretary of War under date of April 29, 1904.

July 1, 1907, balance unexpended	$37.54
July 1, 1908, balance unexpended	37.54

(See Appendix H 4.)

5. Iron pier in Delaware Bay, near Lewes, Del.—The original project for this work proposed the construction of a landing pier about 1,700 feet in length, extending from the shore south of the breakwater into Delaware Bay to a depth of 22 feet at mean low water, the pier to consist of a substructure of wrought-iron screw piles, surmounted by a timber superstructure. The work was commenced in 1871 and completed, except as to superstructure, in 1880.

The work done to June 30, 1890, resulted in the construction of 1,155 linear feet of pier 21 feet in width and 546 linear feet 42 feet in width, or a total length of 1,701 feet. The depth of water at the outer end of the pierhead was about 21 feet at mean low water. Since construction the pier has been repaired and cared for by the United States.

The total expenditures to June 30, 1908, were $385,339.40. Of this amount, $27,000 was applied to the maintenance of the improvement.

The right to use the pier for railway purposes, granted in the act of July 15, 1870, has never been exercised, and doubtless never will be, as the pier has not sufficient strength to support the weight of modern freight engines. It is therefore impossible to obtain any assistance from the railroad company in maintaining and repairing the structure.

During the past fiscal year no work was in progress.

The pier is of great use for the purposes of the Government engineer, light-house, and quarantine services. It is of very great value to vessels frequenting the breakwater harbor in winter, when the harbor is packed with floating ice, rendering the anchorage dangerous. At such times vessels eagerly seek its shelter and protection.

It is proposed to hold the available balance of $820.60 for maintenance and repairs as needed.

The mean range of tide at the pier is 4.5 feet.

July 1, 1907, balance unexpended	$820.60
July 1, 1908, balance unexpended	820.60

(See Appendix H 5.)

6. Delaware Breakwater, Delaware.—The final report of the local officer upon this work was submitted June 19, 1899, and is printed in the Annual Report of the Chief of Engineers for 1899, page 1346.

The depths in the protected anchorage vary from 11½ to 18 feet at mean low water, and the harbor is available for vessels drawing up to about 16 feet.

The amount expended on this work up to June 30, 1908, was $2,807,479.06. No portion of this amount has been applied to maintenance.

During the fiscal year ending June 30, 1903, a survey of the breakwater harbor was completed as a part of a survey of the national harbor of refuge.

The mean range of tide is 4.5 feet.

It is proposed to reserve the available balance of $875.64 for repairs to the breakwater and for surveys and examinations of the work.

July 1, 1907, balance unexpended	$875.64
July 1, 1908, balance unexpended	875.64

(See Appendix H 6.)

7. *Harbor of refuge, Delaware Bay, Delaware.*—The project for the construction of this harbor, which was adopted and provided for under the continuous-contract system in the river and harbor act of June 3, 1896, includes the construction of a breakwater on the line of least depth along the eastern branch of the shoal known as the "Shears," and the construction of a row of ice piers across the upper end of the harbor to protect it from ice descending the bay, at a total cost not to exceed $4,665,000.

No expenditures were made on this improvement previous to June 30, 1896.

Up to the close of the fiscal year ending June 30, 1908, $2,238,205.34 had been expended in the construction of the breakwater and ice piers.

No part of this amount was applied to the maintenance of the work.

During the fiscal year ending June 30, 1904, the sum of $338.43 was expended on a survey made of the harbor.

The breakwater was completed on December 11, 1901. The superstructure of the breakwater has a length of 7,950 feet and the substructure a length of 8,040 feet, measured on the low-water line.

A project for the construction of 10 ice piers was submitted on April 5 and approved April 23, 1900. This work was commenced during the fiscal year ending June 30, 1901, and completed November 22, 1902. Seventy-one thousand three hundred tons of stone was deposited in the work.

A project for the construction of additional ice piers was submitted under date of June 7 and approved June 30, 1902. Work under this project was begun August 4, 1902, and completed June 19, 1903. Thirty-seven thousand six hundred and seventy-three tons of stone was deposited, completing 5 ice piers.

A report was submitted under date of November 19, 1902, containing project and estimates for further protection of the harbor. A further report on this subject, containing a detailed project and estimate of cost of the proposed extension of the breakwater at this harbor, was submitted under date of November 14, 1903. Both reports and the recommendations of the Board of Engineers for Rivers and Harbors are published in House Document No. 548, Fifty-eighth Congress, second session, and also contained in the Annual Report of the Chief of Engineers for 1904, pages 1215–1225.

It is proposed to reserve the available balance of $1,128.66 for repairs and surveys and examinations of the work.

The great value of this harbor to commerce is due to its location. It is about equidistant from New York, Philadelphia, and the capes of Chesapeake Bay (the ocean entrance for the ports of Baltimore,

Norfolk, and Newport News), and is therefore an especially convenient port of call for the entire commerce of the North Atlantic coast. It is now largely used by vessels awaiting orders to ports for discharge or loading. During the year ending December 31, 1907, 1,035 vessels (not including small craft) called at this harbor.

By the construction of the breakwater the usefulness of this anchorage has been greatly increased, not only as a port of call but also as a harbor of refuge. Vessels bound from northern to southern or from southern to northern ports are able to go to sea in doubtful weather with the assurance of finding ample protection at the Delaware capes if overtaken by storm.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1216. A map is printed in House Executive Document No. 112, Fifty-second Congress, first session.

The mean range of tide is 4.5 feet.

July 1, 1907, balance unexpended	$1,128.66
July 1, 1908, balance unexpended	1,128.66

(See Appendix H 7.)

8. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Wreck of barge Alice in Delaware River near Tinicum Island.*—This wreck was considered an obstruction to navigation; its removal was authorized on June 30, 1904. The removal of this wreck was completed May 7, 1908, plant belonging to the United States and hired labor being employed in the execution of the work. The total cost of its removal was $422.98.

(*b*) *Wreck of barge Alfred in Delaware River, Philadelphia Harbor.*—This wreck being considered a dangerous obstruction to navigation, its removal was authorized under date of November 7, 1907. The work of removal by contract was completed December 24, 1907, at a total cost of $1,228.42.

(*c*) *Wreck of schooner Eden in Delaware River close to Tinicum Island Range.*—This wreck being considered a dangerous obstruction to navigation, its removal was authorized under date of February 25, 1908. A contract for the removal of this wreck has been entered into, but at the close of the fiscal year the work had not been completed.

(*d*) *Wreck of a houseboat in Delaware River off the wharf at Fort Mott, N. J.*—This wreck being considered a dangerous obstruction to navigation, its removal was authorized under date of June 2, 1908. The removal of this wreck was commenced by employment of plant belonging to the United States and hired labor, but at the close of the past fiscal year had not been completed.

The total amount expended during the past fiscal year upon removal of wrecks was $1,651.40

(See Appendix H 8.)

EXAMINATION AND SURVEY REQUIRED BY THE RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

The local officer was also charged with the duty of making a preliminary examination and survey of *Neversink River, New York*, and reports thereon will be duly submitted.

IMPROVEMENT OF RIVERS AND HARBORS IN THE WILMINGTON, DELAWARE, DISTRICT.

This district was in the charge of Maj. C. A. F. Flagler, Corps of Engineers, to January 17, 1908, in the temporary charge of Maj. J. C. Sanford, Corps of Engineers, from January 17 to March 19, 1908, and in the charge of Major Flagler since March 19, 1908. Division engineer, Col. D. W. Lockwood, Corps of Engineers.

1. Rancocas River, New Jersey.—The Rancocas River is a tributary of the Delaware River, its mouth being about 11 miles above the Pennsylvania Railroad terminal and ferry at Camden, N. J.

In its original condition the minimum depth was 4½ feet at mean low water from the junction of the forks near Centerton to its mouth, a distance of 7½ miles. Above Centerton the depth on the Mount Holly Branch, a distance of 5½ miles, was generally about 2½ feet. From the forks to Moores Landing, the head of navigation on the Lumberton Branch, a distance of 3.6 miles, the low-water depth over shoal places was 3 feet. The mean range of tides at Centerton is about 5 feet.

The original project, which was adopted by Congress in the act of March 3, 1881, proposed the formation, by a dike at Coates bar, and dredging elsewhere, of a channel from 150 to 200 feet wide and 6 feet deep at mean low water from the mouth to Centerton and thence to Mount Holly, a channel 5 feet deep. Operations under this project were carried on from 1881 to 1895, and were directed to the formation of a low-water channel 100 feet wide and 6 feet deep from the mouth to Centerton and 50 feet wide and 5 feet deep for a distance of about 1¾ miles above Centerton.

Since 1895, operations have been confined to improvement of Lumberton Branch by construction of contraction works and by dredging.

No work was done during the past fiscal year. No further work is proposed.

The amount expended on this improvement to June 30, 1908, is $44,500.21, of which $7,000 was on the Lumberton Branch. No part of this was for maintenance. The expenditure during the year was for examination and contingent expenses.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the river between the mouth and the "Forks" and Centerton, was 5 feet.

No complete statistics have been furnished, but it is reported that 442,170 tons of building sand, valued at $104,040, cover the shipments from the river and 2,500 tons of pig iron, valued at $50,000, cover the shipments to the river. No statement of vessels trading in the river could be obtained. It was also impracticable to ascertain what direct effect the improvement of the channel has had upon freight rates.

July 1, 1907, balance unexpended	$20.76
June 30, 1908, amount expended during fiscal year	20.76

(See Appendix I 1.)

2. Cooper Creek, New Jersey.—This creek enters the Delaware River in the city of Camden, just above Cooper Point. It was navigable at mean high water for a distance of 9 miles from its mouth for

vessels drawing 5 feet, and for the first 5 miles for vessels of 11½ feet draft. The mean range of the tide at the mouth is about 6 feet. For a distance of 1½ miles from the mouth the width of the stream averaged about 80 feet at low water and about 120 feet between the banks, and the channel in its original condition had a depth at mean high water of from 12 to 15 feet, except at one place where the depth was 9½ feet.

The project for this improvement was adopted in the river and harbor act of June 3, 1896, and is printed in the Annual Report of the Chief of Engineers for 1895, page 1102. It provides for the formation, by dredging, of a channel 70 feet wide at bottom and 18 feet deep at mean high water from the mouth of the creek to Browning's Chemical Works and a channel of the same dimensions through the bar just outside the mouth—in all, a distance of about 9,000 feet. The estimated cost, including contingencies, is $35,000.

The river and harbor act of June 3, 1896, appropriated $37,000 for completing this improvement, of which $2,500, or as much thereof as might be necessary, was to be expended in rebuilding the dike on the government reservation in the Delaware River at Woodbury Creek.

The sum of $2,500 was expended in rebuilding the dike at Woodbury Creek referred to, and the channel in Cooper Creek was dredged. This dredging resulted in the formation of a channel extending from the mouth to the Camden Iron Works, 7,500 feet long, 50 to 70 feet wide, except at the bridges, where the widths are 30 feet, and 18 feet deep at mean high water (12 feet at mean low water). At State street the depth made was only 14 to 15 feet on account of a city water main crossing the stream at that depth. Further operations were suspended to await the lowering of this pipe, which was contemplated by the city. The lowering of this pipe was completed in September, 1907. About 65 per cent of the projected work is completed.

No work was done on the improvement during the past fiscal year. The expenditure was for examinations and contingent expenses.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part of the channel was 10 feet from the Delaware River to Federal Street Bridge, thence 7 feet to the Camden Iron Works, and thence 6 feet to Browning's Chemical Works.

The amount expended to June 30, 1908, is $31,000.68, exclusive of the $2,500 expended in rebuilding dike at Woodbury Creek. Of this amount $5,324.58 was for maintenance.

It has been impracticable to procure complete commercial statistics, but so far as received the total tonnage of receipts and shipments on the creek for the calendar year ending December 31, 1907, was 364,611, valued at $1,632,210.

The effect of the improvement made in this stream on freight rates is that it has reduced the rates by permitting larger vessels to be secured for long voyages, which was formerly impossible. The railroad rates to points in the United States east of Cape Cod are 25 per cent higher than by water.

It is proposed to expend the funds recommended below to completion to project dimensions of the channel above the State Street Bridge and in maintenance work.

June 1, 1907, balance unexpended	$3,529.24
June 30, 1908, amount expended during fiscal year for maintenance of improvement	29.92
July 1, 1908, balance unexpended	3,499.32
Amount (estimated) required for completion of existing project	5,072.96
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	11,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix I 2.)

3. Mantua Creek, New Jersey.—Mantua Creek is a stream flowing into the Delaware River at a point about 10 miles below the terminal and ferry of the Pennsylvania Railroad at Camden, N. J.

In its original condition it was navigable at high water for a distance of one-half mile above its mouth to the phosphate works of the I. P. Thomas & Sons Company for vessels of 13 feet draft; thence 3¼ miles farther, to Paulsboro, for vessels drawing 9 feet; thence 3¼ miles to Parkers Landing for tugs and barges drawing 6 feet, this being the head of steam navigation; thence 4.1 miles to Mantua, 11¼ miles above the mouth, small boats and barges of 3 to 4 feet draft passed up on the tide. The navigable portion is generally bordered by low ground, protected from overflow by earthen banks. The general course of the stream is tortuous, and its navigation was much obstructed by bars, sharp bends, and the upper portion by stumps and overhanging trees. The stream, on account of its flat watershed, is subject to only moderate freshets, which seldom exceed 2 to 3 feet above tide water. The range of tide is 6 feet at the mouth, 4.5 feet at Paulsboro, 3.4 feet at Berkley, and 2 feet at Mantua, which is the head of navigation. The low-water width near the mouth averaged 160 feet, decreasing to about 100 feet at Paulsboro. Above Paulsboro the width decreased to 88 feet at Parkers Landing, and near Mantua to 50 feet.

The approved project for the improvement, which was adopted by Congress in river and harbor act of March 3, 1899, contemplates the dredging of a channel 100 feet wide on the bottom and 12 feet deep from the 12-foot contour in the Delaware River, through the marsh to the phosphate works, a distance of 2,200 feet; thence 80 feet wide on the bottom and 8 feet deep to Paulsboro, 6,300 feet, making a channel nearly direct by cutting off three bends; thence to Parkers Landing, near Berkley, 3 miles, with one cut-off 60 feet wide and 7 feet deep; and the dredging of a cut-off 350 feet long, 50 feet wide, and 3 feet deep, 9,000 feet above Berkley; also the removal of overhanging trees above Berkley and the construction of jetties on both sides at the mouth of the creek. The estimated cost of this improvement is $115,030. Such lands and rights as were considered necessary for the cut-offs were purchased in September, 1900, at a cost of $8,000. The channel between the phosphate works and Paulsboro has been dredged to the project dimensions and the three cut-offs made as planned, and a channel 12 feet deep at mean low water dredged direct from the 12-foot contour in the Delaware River to the phosphate works, cutting off the old mouth, the width made being 110 feet across the flats and 100 feet at the upper and lower ends of this dredging.

Work for the protection of the channel at the new mouth to the extent of the available funds was begun on November 8, 1906, under a

contract for jetty and dike construction, and to the end of the fiscal year 307 linear feet of jetty had been built on the east side of the entrance to the creek and 301 feet on the west side; also 186 feet of dike to close a gap in the bank of dredged material, just inside of the entrance. The work on this contract closed July 2, 1907, the remaining 199 feet of dike to make it 385 feet long, having been completed.

The river and harbor act of March 2, 1907, appropriated $34,450 for continuing the improvement and authorized a sufficient amount thereof to be applied to the construction of a dike to close the old mouth of the creek; and with this appropriation a length of 447 feet was added to the east jetty and 278.5 feet to the west jetty, completing them and making them respectively 754 feet and 579.5 feet long; and a dike to close the old mouth of the river, 524 feet long, was constructed. A contract was also entered into for dredging the channel to a depth of 12 feet at mean low water from the Delaware River to the I. P. Thomas & Sons Company's fertilizer works, thence 8 feet to the county bridge, and the removal of shoals above to 7 feet. This dredging is expected to begin shortly.

The amount expended on the improvement to June 30, 1908, is $84,282.84, of which $81,282.84 is on the present project. No expenditure has yet been made for maintenance. About one-half of the project remains to be done.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part of the creek under improvement was 10 feet to the phosphate works, thence 6 feet to Paulsboro, and thence 2½ feet to Parkers Landing.

It has been impracticable to obtain commercial statistics for the calendar year 1907, but the tonnage reported for 1906 was 240,220, valued at $984,700.

The appropriation recommended will be applied toward construction of the project channel above Paulsboro, and to maintenance of the channel below Paulsboro by dredging and bank repairs.

July 1, 1907, balance unexpended	$37,850.32
June 30, 1908, amount expended during fiscal year for works of improvement	24,683.16
July 1, 1908, balance unexpended	13,167.16
July 1, 1908, amount covered by uncompleted contracts	9,500.00
Amount (estimated) required for completion of existing project	50,580.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	31,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix I 3.)

4. Raccoon Creek, New Jersey.—This creek rises in Gloucester County, flows in a northwesterly direction, and empties into the Delaware River at a point nearly opposite Marcushook, Pa. A preliminary examination and survey of Raccoon Creek was made in 1899, and a report, with estimated cost of improvement, is printed in Annual Report of the Chief of Engineers for 1900, pages 1590-1598.

It was navigable at high water for a distance of 1¾ miles above its mouth to Bridgeport for vessels of 9 feet draft, thence 3¼ miles

farther to Springer's wharf for vessels drawing 7 feet, and thence 4¾ miles to Swedesboro, the head of steam navigation for boats and barges having a draft of 4 feet. Above Swedesboro the stream was narrow, shoal, and very crooked. The navigable portion, when it left fast land, wound through meadows lying 2 or 3 feet above low water, which, except for the 2 miles immediately below Swedesboro, were generally protected from overflow by revetted earthen banks. Navigation was much obstructed by bars and a few sharp bends.

The range of tide varies from 6 feet at the confluence with the Delaware River to 4.9 feet at Swedesboro, where it is considerably influenced by winds and freshets.

The approved project, adopted by river and harbor act of June 13, 1902, proposes the formation of a dredged channel 7 feet deep and 75 feet in width at mean low water from the mouth for a distance of 1¾ miles to Bridgeport, thence a channel of the same depth and 60 feet wide to Springer's wharf, and thence a channel 5 feet deep at mean low water and 40 feet in width to the head of navigation at Swedesboro, 9¾ miles from its mouth, together with the widening of the channel around sharp bends, at an estimated cost of $102,135. A continuous channel has been dredged from the mouth of the creek to the highway bridge at Bridgeport and thence across Springers bar. The length improved was about 5 miles.

The channel between the Delaware River and Springer's wharf has been redredged to the project dimensions, and above the latter point the channel has been dredged to a depth of 5 feet at mean low water and a width of 40 feet to the head of navigation at Swedesboro. This completed about three-fourths of the project.

No work has been done on the improvement during the past fiscal year. The disbursements were for outstanding liabilities and examinations.

The river and harbor act of March 2, 1907, appropriated $15,000 for continuing the improvement and for maintenance, and authorized a sufficient amount thereof to be applied to the making of a cut-off at Molonox shoal, with proviso that no expenditure shall be made thereon until the land needed therefor shall have been deeded to the United States free of expense.

The project for the expenditure of this appropriation provides for making the proposed cut-off and redredging the channel where it has shoaled to its project dimensions from the Delaware River to Swedesboro, and this work is to be undertaken as soon as title is secured to the land required for the cut-off. The title papers are now in the hands of the Department of Justice.

The amount expended on the improvement to June 30, 1908, is $24,058.31, of which $3,055.43 was for maintenance.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the creek was 7 feet from the Delaware River to Bridgeport, 6 feet to Springers, and 5 feet thence to Swedesboro.

The improvement of the stream has so far had no marked effect upon freight rates, as sufficient time has not elapsed since the dredging was extended to Swedesboro. Bulky freight by water, however, costs only about half that by rail.

The commerce of the creek during the calendar year 1907, as reported, was 78,478 tons, valued at $744,750.

The present project as estimated is complete except as to widening at bends and the construction of the cut-off at Molonox shoal, but the execution of the work has improved the stream by increasing the tidal range in the upper waters about 1 foot. To effect the provisions of the project it is therefore necessary to do additional dredging to secure the low-water depth provided.

It is proposed to expend the funds recommended together with the available balance, in executing the cut-off at Molonox shoal, obtaining the project depth on the new mean low-water level, in widening at bends and in maintenance.

July 1, 1907, balance unexpended	$24,457.34
June 30, 1908, amount expended during fiscal year for maintenance of improvement	515.65
July 1, 1908, balance unexpended	23,941.69
Amount (estimated) required for completion of existing project	57,135.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	15,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix I 4.)

5. Salem River, New Jersey.—In 1872 the upper part of this river was separated from the lower part by a dam and was connected with the Delaware River by a canal forming two independent streams with mouths about 10 miles apart.

Prior to the adoption of the present project $17,209.34 had been expended on improvement of this stream, of which $10,000 was applied to work in Salem Cove, at the natural mouth below Salem, with which a channel 8 feet deep and 100 feet wide at low water was obtained, and $7,209.34 to improvement of the upper river in the formation of a channel 6 feet deep and 50 feet wide at mean low water up to Hoxies Landing.

Report of survey on which the present project is based is printed in the Annual Report of the Chief of Engineers for 1897, page 1245, and report thereon by the Board of Engineers for Rivers and Harbors is printed in River and Harbor Committee Document No. 12, Fifty-ninth Congress, second session.

The existing project was adopted by the river and harbor act of March 2, 1907, which appropriated $29,000 for completion of the improvement. It provides for dredging the lower river below Salem 100 feet wide and 9 feet deep at mean low water, amplifying at the bends so as to permit the passage of vessels 200 feet long from Delaware River up to the highway bridge over Little Salem Creek, including the removal of the stony bars in front of the city wharves and at the bend above the brickyard. The estimated cost of this work, as given by the Board of Engineers for Rivers and Harbors in report of January 16, 1907, is $29,000, subsequently increased to $38,600.

After an examination of the channel proposals were invited in July, 1907, for the required dredging, but as only one bid was received, at 27.5 cents per cubic yard, which was considered excessive, it was rejected. Proposals were again opened in May, 1908, under more favorable conditions, the lowest bid received this time being 19.9 cents per cubic yard.

In the examination above referred to it was found that the amount of material to be excavated to obtain the project channel dimensions, with an allowance of 1 foot for overdepth dredging, would be considerably in excess of that given in the report of survey of 1897, and upon recommendation of the Chief of Engineers, the Secretary of War, in accordance with section 2 of the river and harbor act of March 2, 1907, authorized the expenditure of the available funds to the excavation of a channel of such dimensions as could be secured thereby. Accordingly, contract was entered into for dredging a channel 9 feet deep at mean low water, with an allowance of 1 foot for overdepth where made, and 100 feet wide from the mouth of the river to deep water in Delaware Bay and 75 feet wide from the mouth up to the highway bridge. This diminished channel will afford sufficient accommodation for navigation until additional funds become available. The estimate for completion is submitted below.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part of the river under improvement between Salem and the Delaware River is 5.5 feet.

The amount expended on this improvement to June 30, 1908, is $936.89, no part of which was for maintenance. Expended on previous project, $17,209.34. Total, $18,196.23.

It has been impracticable to obtain commercial statistics for the calendar year 1907. The commerce of Salem reported for 1906, and which is believed to be the commerce by both rail and water, was 373,280 tons, valued at $15,411,834.

In view of the fact, as stated above, that the approved project can not be completed with the funds appropriated on the original estimate for completion, recommendation is made below for an additional appropriation of $9,600 to complete the project, and for the necessary funds to maintain for one year the channel as now about to be constructed with available funds.

July 1, 1907, balance unexpended	$28,681.21
June 30, 1908, amount expended during fiscal year for works of improvement	618.10
July 1, 1908, balance unexpended	28,063.11
July 1, 1908, amount covered by uncompleted contracts	26,000.00
Amount (estimated) required for completion of existing project	9,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	14,600.00

(See Appendix I 5.)

6. Alloway Creek, New Jersey.—This is a tidal tributary of the Delaware River, flowing westerly in the southwestern part of New Jersey, its mouth being about 50 miles below Camden, N. J. In its original condition the creek was obstructed between its mouth and Quinton, a distance of about 10 miles, by shoal areas in the upper half of the stream, which reduced the low-water depths to from 1.3 to 4 feet. The mean range of tide is 6 feet at the mouth and 4 feet at Quinton, the head of navigation.

The original project of 1889 proposed the formation by dredging of a channel 6 feet deep at mean low water and 60 feet wide from Quinton to a point about 1,000 feet above upper Hancock Bridge; thence a channel of the same depth and 75 feet wide to a locality known as "The Square," where the work was to be supplemented by a dike. At a locality known as the "Canal," in addition to a channel of the last-named dimensions, the width of the stream was to be increased to about 150 feet between its low-water lines. The project was modified on December 10, 1896, so as to provide for a dike formed by a single row of piles above upper Hancock Bridge. This modification did not increase the original estimated cost of the work, which is $25,000.

Channels from 40 to 75 feet wide and 6 feet deep at mean low water have been dredged at various localities, and dikes 300 and 404 feet in length, respectively, have been constructed at "The Square" and above upper Hancock bridge. The channel has been dredged at various points between the upper end of a shoal just above Hancock bridge and a point about 3 miles below, forming a continuous channel 6 feet deep at mean low water and 60 feet wide between the points named. There has been dredged a channel not less than 75 feet wide and 6 feet deep at mean low water from the mouth of the creek to a point about one-half mile below the highway bridge at Hancocks, a distance of 4.92 miles. This completed about three-fifths of the project.

No work was done on the improvement during the past fiscal year. The expenditure was for examinations and contingent expenses.

The river and harbor act of March 2, 1907, appropriated $5,000 for continuing improvement and maintenance, and authorized a sufficient amount thereof to be applied to the construction of a cut-off at Fosters Bottle, with the proviso that no expenditure shall be made thereon until all land needed for such cut-off shall be deeded to the United States free of expense.

A project for the expenditure of this appropriation under the conditions of the law has been approved, and at the close of the fiscal year work thereon is awaiting the result of negotiations for the acquisition of the land needed for the proposed cut-off. The title papers are now in the hands of the United States district attorney for New Jersey, for his opinion as to their sufficiency.

The amount expended on the improvement to June 30, 1908, is $23,967.13, of which $7,478.11 was for maintenance.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part of the locality under improvement to Quinton was 4½ feet.

The commerce of the creek consists of miscellaneous articles, such as coal, sand, lumber, agricultural products, etc. The tonnage for the calendar year 1907 was 66,515, valued at $1,040,000.

The freight rates are reported to have been lowered by reason of the improvement of the creek, but to what extent is not stated. Larger boats are enabled to enter and depart, and shipments have been facilitated very much by avoiding delays in waiting for tides.

It is proposed to apply the appropriation recommended below in maintenance of the channel now made and to be made under available funds.

July 1, 1907, balance unexpended	$5,446.63
June 30, 1908, amount expended during fiscal year for maintenance of improvement	413.76
July 1, 1908, balance unexpended	5,032.87
Amount (estimated) required for completion of existing project	200.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	7,000.00

(See Appendix I 6.)

7. *Cohansey River, New Jersey.*—In its original condition this river or creek was navigable to Bridgeton, 19 miles above the mouth, through a tortuous channel of ample depth. The obstructions to navigation were found at Bridgeton, where the city gas and water mains were laid at a depth of only 4 feet below low water, and at the mouth, where the river discharged into Delaware Bay across a soft mud bar without any well-defined channel. At Bridgeton there is a fixed bridge known as the Nail Works Bridge, and just above the bridge is a milldam which limits the tidal basin of the stream.

Prior to adoption of the present project $36,000 had been expended in dredging a channel 7 feet deep at mean low water 70 to 90 feet wide to the Broad Street Bridge, 40 feet wide above to the Commerce Street Bridge, thence 4 feet deep to the Nail Works Bridge.

The present project is printed in House Document No. 645, Fifty-ninth Congress, first session, and was adopted in the river and harbor act of March 2, 1907. It provides for dredging a cut 100 feet wide and 7 feet deep at mean low water at the mouth, and for dredging a channel to the same depth in the river from Stony Point to the Nail Works Bridge, the widths to be 100 feet to Broad Street Bridge, thence 75 feet to the Commerce Street Bridge, and thence 60 feet to the Nail Works Bridge, at an estimated cost of $55,800, which is the amount appropriated.

The range of tides at Bridgeton is nearly 7 feet, which was practically all the available depth along the wharves of the town.

The gas and water mains obstructing the channel at Bridgeton having been removed, the channel was dredged between August, 1907, and February, 1908, from deep water at Stony Point to the nail works, the depth made being 8 feet at mean low water—which included 1 foot for overdepth allowed under the contract—100 feet wide to Broad street, 75 feet wide thence to Commerce street, and 60 feet wide thence to the Nail Works Bridge.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part of the locality under improvement was 7 feet to head of navigation and 5 feet over the bar at the mouth.

No work can be done at the mouth until title has been secured to a tract of land needed for a cut-off. Negotiations for the transfer to the United States of this land free of cost have been in progress for some time, but owing to legal obstacles have not yet been consummated.

The amount expended on this improvement under the present project to June 30, 1908, is $23,103.89, no part of which was for maintenance.

But a short period has elapsed since the recent improvement of the channel, and it has been impracticable to obtain commercial statistics for 1907. The commerce, which was very large for years prior to 1884, was only about 16,800 tons in 1906, owing to the deterioration of the channel.

It is proposed to expend the funds recommended below in maintenance work on the channel recently completed in the upper river for two years and for one year in the channel at the mouth soon to be completed with available funds.

July 1, 1907, balance unexpended	$55,768.78
June 30, 1908, amount expended during fiscal year for works of improvement	23,072.67
July 1, 1908, balance unexpended	32,696.11
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	6,000.00

(See Appendix I 7.)

8. *Tuckerton Creek, New Jersey.*—This is a tidal stream flowing into Little Egg Harbor, on the Atlantic coast, northeast of Atlantic City. A preliminary examination and survey of the creek were made, and a report recommending its improvement is printed in Annual Report of the Chief of Engineers for 1900, pages 1612–1615.

The original low-water depth at Tuckerton, the head of navigation, was 15 inches, which increased gradually to 4 feet at the mouth of the creek, a distance of 2 miles. From the mouth of the creek across the flats to Gaunts Point, seven-eighths of a mile, the low-water depths were 2 to 2½ feet. The mean tidal range is 2½ feet.

The existing project, adopted by the river and harbor act of June 13, 1902, contemplates the dredging of a channel 6 feet deep at mean low water and 80 feet wide from Gaunts Point, seven-eighths of a mile, to the mouth of the creek; thence a channel of the same depth and 75 feet wide, 1 mile, to Parkers Landing; thence a channel of the same depth and 60 feet wide, five-eighths of a mile farther, to West Tuckerton Landing; thence a channel 5 feet deep at mean low water and 60 feet wide for three-eighths of a mile to just above Scow Landing, and thence a channel 3 feet deep at mean low water and 40 feet wide for one-eighth of a mile to the milldam at Tuckerton, together with the widening of the channel at sharp bends; the channel across the cove between the mouth of the creek and Oyster Bed Point to be supplemented, if necessary, by a revetment wall along its northern side. The estimated cost of the work, including contingencies, is $61,380. Under authority contained in the river and harbor act of March 3, 1905, the Secretary of War authorized the location of the channel at the mouth to be changed so as to lead it in a south-southeast direction directly to the deep water at the head of Marchelder channel instead of to Gaunts Point.

The channel has been dredged to the project widths from the mouth of the river to a point 2,100 feet below the milldam at Tuckerton, the depth made being 6 feet at mean low water, except the upper 581 feet, which was dredged to 5 feet at mean low water. This completed about one-half of the project.

The river and harbor act of March 2, 1907, appropriated $12,000 for continuing the improvement, and a project for the expenditure of the appropriation was duly approved by the Chief of Engineers. This included dredging of the cut from the mouth of Tuckerton Creek to the Marchelder channel. It was then found, however, that dredging along that line would destroy several oyster beds held and owned by private parties under leases from the State of New Jersey, and it was therefore concluded to defer operations until this matter could be adjusted.

Under date of December 16, 1907, the chief of the bureau of shell fisheries of the State of New Jersey advised this department that all objections to the proposed dredging had been removed, and thereupon contract for the dredging was entered into and the work is expected to begin shortly. The contract provides for dredging a straight channel from deep water of Marchelder channel off Parkers Island across the flats of Little Egg Harbor to the mouth of Tuckerton Creek, passing through the point on the southwest side of the mouth, and then dredging, as far as the available funds will permit, the upper river, the depths to be 5 feet at mean low water from Marchelder channel to Scow Landing and thence 3 feet to the milldam.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part of the improvement is 2 feet from the milldam to Scow Landing, 4 feet thence to West Tuckerton, 5.5 feet thence to Parkers, 6 feet thence to the mouth, and thence one-half foot to head of Marchelder channel.

The amount expended on this improvement to June 30, 1908, is $23,966.91, of which $2,215.14 was for maintenance.

The commerce reported for the calendar year 1907 is 4,185 tons, valued at $1,310,945.

The improvement of Tuckerton Creek is not yet sufficiently advanced to show any material decrease in freight rates. Shipments from distant points have, however, been increased and facilitated, although lumber-laden vessels still are obliged to await tides at the flats at the mouth to enter the creek.

As the project progresses it is believed that cost of maintenance will decrease.

It is proposed to expend the funds recommended below in restoring and maintaining the present channel and in completing the work under the approved project:

July 1, 1907, balance unexpended	$12,242.23
June 30, 1908, amount expended during fiscal year for maintenance of improvement	209.14
July 1, 1908, balance unexpended	12,033.09
July 1, 1908, amount covered by uncompleted contracts	10,800.00
Amount (estimated) required for completion of existing project	27,380.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	29,380.00

(See Appendix I 8.)

9. Cold Spring Inlet, New Jersey.—This is a new work. The locality is on the coast of New Jersey, about 3 miles east of the city of Cape May. Within the inlet there was originally a natural basin about 6 feet deep and 60 acres in area. In the throat of the inlet the depth was 29 feet at mean low water and on the outside bar there was a minimum depth of 3.5 feet at low water about one-half mile out. There was no commerce.

Improvement of the locality was begun by private parties to enlarge the basin inside the inlet to about 500 acres in area, with a depth of 30 to 40 feet; and to complete the plan for a safe land-locked harbor for commerce and refuge, the General Government has undertaken to provide a suitable connection between it and the deep water in the ocean, so as to make the harbor accessible to seagoing vessels.

The plan of improvement adopted by the river and harbor act of March 2, 1907, contemplates providing an entrance channel 25 feet deep at mean low water by construction of parallel jetties 750 feet apart and dredging between them, at an estimated cost of $1,311,700. The adoption of this project was conditional upon the contribution of $100,000 toward the improvement by local authorities or private parties. This contribution was made by deposit on February 28, 1908, with the Assistant Treasurer of the United States at Philadelphia, Pa., of $100,000 to the credit of Maj. C. A. F. Flagler, Corps of Engineers, the district engineer officer, by the Cape May Real Estate Company. The work is being done under continuing contracts for completion, $663,800 remaining to be appropriated.

All the requirements of the act of 1907 relative to conveyance of land, etc., have been carried out and the deeds of conveyance to the United States approved by the Department of Justice.

The dredging of the harbor is a little more than one-half completed and though no work is in progress at present it is understood that the Cape May Real Estate Company is soon to resume operations thereon.

The report of survey upon which the plan of improvement is based is printed in House Document No. 388, Fifty-ninth Congress, second session.

On October 3, 1907, proposals were opened for the required jetty work and award made to the lowest bidder, the Seacoast Construction Company, of New York. This company, however, failed to execute the contract required, and later, upon evidence that it had been merged into the Breakwater Construction and Engineering Company, a contract dated January 18, 1908, was entered into with that company on the bid submitted by the Seacoast Construction Company, the work to be commenced within sixty days and completed within two years and two months after notification of approval of the contract, which was given April 20, 1908. At the close of the fiscal year the contracting company had not begun the work at the site of the jetty, but was assembling its plant and getting its quarry in order for the shipment of the required stone.

All the necessary arrangements have been made for beginning the work, including borings, surveys, preparation of detailed plans, the construction of quarters and office for the assistant engineer, inspectors, etc., inspection launch and other means of transportation for employees on the work, etc.

The range of tide at the inlet is 4 feet.

The amount expended on this improvement to June 30, 1908, is $18,220.42.

It is proposed to apply the appropriation recommended toward completion of the jetties and in dredging in accordance with the approved project.

July 1, 1907, balance unexpended	$311,000.00
Amount appropriated by sundry civil act approved May 27, 1908	236,200.00
Amount contributed by private parties	100,000.00
	647,200.00
June 30, 1908, amount expended during fiscal year for works of improvement	18,220.42
July 1, 1908, balance unexpended	628,979.58
July 1, 1908, amount covered by uncompleted contracts	614,600.00
Amount (estimated) required for completion of existing project	663,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	265,000.00

(See Appendix I 9.)

10. Wilmington Harbor, Delaware.—The harbor of Wilmington, Del., is in the Christiana River and includes a length of about 4 miles above its mouth at the Delaware River. It also includes the navigable portion of the Brandywine River (2 miles), which flows into the Christiana River at a point about 1¾ miles above its mouth.

Previous to 1836, when the first appropriation for the improvement of the Christiana River was made, the low-water depth at the entrance to this stream was about 8½ feet. The minimum depth in the channel in the portion of the river below Third Street Bridge, Wilmington, was 8 feet. This depth was increased in 1836 by dredging to 10 feet below low water, and under projects of 1871 and 1881 to 12 and 15 feet, respectively.

The present project is based upon a survey made in 1895 and adopted in river and harbor act of June 3, 1896. It provides for the formation, by dredging, rock removal, and construction of dikes, of a channel in the Christiana River 21 feet deep at mean low water from that depth in the Delaware River to the pulp works, a distance of about 4 miles, and thence diminishing to a depth of 10 feet at mean low water to the draw pier of the Philadelphia, Baltimore and Washington Railroad cut-off bridge No. 4, the width at bottom varying between 250 feet at the mouth and 200 feet at bridge No. 4. The project further provides for the removal of shoals from bridge No. 4 to Newport to a depth of 7 feet at mean low water. This project was completed in 1906. The depth made over the rock ledges just above and below the Third Street Bridge is about 21½ feet.

Further work contemplated is for maintenance of the improvement.

Under an act of the legislature of the State of Delaware, approved March 9, 1901, authorizing the city of Wilmington to contribute to the extent of 10 per cent of the amount expended by the United States Government, for the improvement of Wilmington Harbor, the

sum of $4,400.54 was expended by the city of Wilmington in dredging the channel between the Third Street Bridge and the Market Street Bridge, resulting in a continuous channel 75 feet wide and 17 feet deep at mean low water between the points named and connecting them with the channel dredged by the General Government. This work was done under the supervision of the local United States engineer officer.

The city of Wilmington has also, under the State law above referred to, recently appropriated the further sum of $6,567.41 as its contribution for the improvement of Wilmington Harbor, and this will shortly be expended in dredging under the supervision of this department as heretofore.

Under a contract made for the expenditure of part of the appropriation made by the river and harbor act of March 2, 1907, repairs were made to the jetties at the mouths of the Brandywine and Christiana rivers and the channel was dredged to a depth of 19 feet at mean low water, which included an allowance of 1 foot for overdepth under the contract, from the Delaware River to a point about 1,200 feet above Lobdell's canal, and from a point opposite Harlan & Hollingsworth's dry dock for a length of 1,025 feet downstream, the width made in the lower river being 250 feet and in the upper river 200 feet. On June 30, 1908, the channel had a depth of 18 feet at mean low water, with a width of 250 feet between the mouth and the Pennsylvania Railroad cut-off bridge No. 3; thence 18 feet with a width of 150 feet to Third Street Bridge; thence 13 feet with a width of 150 feet to Market Street Bridge; thence 18 feet with a width of 200 feet to the Harlan & Hollingsworth dry dock; thence 18 feet with a width of 100 feet to the Baltimore and Ohio Railroad bridge; thence 9 feet with a width of 100 feet to the Pennsylvania Railroad cut-off bridge No. 4; and thence 6 feet with a width of about 100 feet to Newport.

Between January 28 and February 21, 1908, a large water-soaked log lying in the channel of the Christiana River about 1,000 feet above Churchman's bridge, and four large stumps lying in the channel about 2,000 feet above the bridge, were removed from the river, at a cost of $234.81, with an allotment approved by the Secretary of War December 30, 1907, from the appropriation for emergencies made by the river and harbor act of March 2, 1907.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part of the river under improvement was 15 feet to Harlan & Hollingsworth's shipyard, and 9 feet thence to the pulp works.

The amount expended on this improvement from 1836 to June 30, 1908, is $969,326.28. Of this amount $567,205.07 was expended on the present project, and of which $123,553.44 was for maintenance. This is exclusive of $234.81 expended from appropriation for emergencies in removal of obstructions from the channel above Churchman's bridge.

The tonnage and value of the leading articles shipped to and from the port of Wilmington in the calendar year 1907 is reported to have been 793,887 tons, valued at $66,869,037.

The shipbuilding industry on the river is quite extensive, the records of the Department of Commerce and Labor showing that,

with the exception of Philadelphia and Newport News, Wilmington had the largest steel-ship building output on the Atlantic coast for the ten years ending June 30, 1905.

The harbor improvements do not directly affect freight rates on light-draft boats to any large extent. Shipments thereon made by water range about 25 per cent lower in rate than by rail, but much more in deep-draft vessels, of which there are many, covering shipments to and from the manufacturers and shipbuilding plants.

As the present project has been completed, further expenditures on the harbor will be for maintenance.

GENERAL IMPROVEMENT.

July 1, 1907, balance unexpended	$83,931.31
June 30, 1908, received from sales of property	31.00
	83,962.31
June 30, 1908, amount expended during fiscal year for maintenance of improvement	49,819.78
July 1, 1908, balance unexpended	34,142.53
July 1, 1908, outstanding liabilities	14,500.00
July 1, 1908, balance available	19,642.53
July 1, 1908, amount covered by uncompleted contracts	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	237,000.00

EMERGENCIES IN RIVERS AND HARBORS.

Amount allotted from appropriation of March 2, 1907	$1,250.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	234.81
July 1, 1908, balance unexpended	1,015.19

(See Appendix I 10.)

11. Appoquinimink, Murderkill, and Mispillion rivers, Delaware.—(*a*) *Appoquinimink River.*—At the time of the adoption of the present project there was a mean low-water depth of 2 feet at the entrance into Delaware Bay, and the shoalest depth inside the river was 4½ feet. The most serious obstructions to the navigation of the river were the many bends in the lower and middle sections.

The approved project is based upon a survey made in 1889, and adopted by Congress in river and harbor act of September 19, 1890. It provides for a channel 8 feet deep at mean low water, having a width of 80 feet from the bridge at Odessa, the head of navigation, to New bridge, near Townsend's wharf, a distance of 3¼ miles, and a width of 100 feet from this wharf to the mouth of the river, a distance of 5 miles. The estimated cost of the improvement is $39,963.

A history of the work done up to June 30, 1905, may be found in the Annual Report of the Chief of Engineers for 1905, pages 175–176.

With $5,500 allotted by the Secretary of War in 1905 from the appropriation made by the river and harbor act of March 3, 1905, for

improving Appoquinimink, Murderkill, and Mispillion rivers, a cut-off was made through the neck of land on the left bank of the river leading to Fennimore's (or New) bridge, about halfway between the mouth and Odessa. This cut-off shortened the channel distance by 2,272 feet, the distance between Odessa and the 7-foot contour in Delaware Bay being now about 6¾ miles.

Under the provisions of the river and harbor act of March 2, 1907, the Secretary of War on March 20, 1907, approved an allotment of $6,400 for expenditure on this improvement. Of this amount $5,000 pertained to the act referred to and the remainder was funds pertaining to former allotment. With these funds the channel has been dredged to not less than 7 feet deep at mean low water and 50 feet wide between Odessa and the mouth.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part of the river was 7 feet, and across the flats at the mouth 4 feet.

The amount expended on the improvement to June 30, 1908, is $41,174.14, of which $9,131.73 was for maintenance.

About two-fifths of the work on the project remains to be done to complete it.

The commerce of the river for the calendar year 1907 is reported to have been 33,525 tons, valued at $2,238,950.

The freight rates, it has been reported, remain about the same, but the passenger business has increased in consequence of the improvement of the river.

It is proposed to expend the funds recommended below in completing to project dimensions the channel of the river and in maintenance work.

July 1, 1907, balance unexpended	$6,049.80
June 30, 1908, amount expended during fiscal year for maintenance of improvement	4,627.03
July 1, 1908, balance unexpended	1,422.77
Amount (estimated) required for completion of existing project	7,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *Murderkill River.*—This river is a tidal stream and a tributary of Delaware Bay and flows through Kent County, Del. Its navigable portion is about 9 miles long. The condition of the river was fair for the greater part of its length, the average width and depth being 90 and 6 feet, respectively. Outside the junction with Delaware Bay, however, there was a serious obstruction—the flats, which are nearly bare at low tide and extend for nearly a mile from the shore. The average rise and fall of the tide at the mouth is 4.6 feet.

In 1881 an examination of this river was made and a project submitted for its improvement. No appropriation was made by Con-

[a] See consolidated money statement on page 212.

gress, however, as the river was at that time in the hands of an improvement and navigation company chartered by the State. This company had expended about $10,000 in rectifying the many bends of the river by cutting straight canals and in dredging a narrow cut across the flats at the mouth. The latter slowly filled up again.

Under the provisions of the river and harbor act of September 19, 1890, a survey was made and report thereon is printed in House Executive Document No. 21, Fifty-second Congress, first session.

The project for improvement, which was adopted in the river and harbor act of July 13, 1892, is for a 7-foot low-water channel, 80 feet wide from the town of Frederica, at the head of navigation, to the mouth of the river, and 150 feet wide from the mouth, across the flats outside to the 7-foot curve of depth in Delaware Bay, the cut at the mouth to be protected by forming an embankment of the dredged material on each side, the estimated cost being $47,550.

Dredging for original work and for maintenance has been done at different times since 1893. A history of operations to June 30, 1905, will be found in the Annual Report of the Chief of Engineers for 1905, pages 177–178.

With funds derived from the river and harbor appropriations of March 3, 1905, and March 2, 1907, and emergency appropriation of 1905, the river has been dredged at various points and across the flats at the mouth, resulting in a channel not less than 50 feet wide and 6 feet deep at mean low water from Frederica to the 6-foot curve in Delaware Bay. The channel has since shoaled.

About 50 per cent of the project has been completed.

An allotment of $3,000 has been made from the emergency appropriation provided by the river and harbor act of March 2, 1907, to be applied to the maintenance of the river. Work under contract was begun on June 30, 1908.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part of the river under improvement is 5 feet from Frederica to the mouth and 5 feet across the flats to Delaware Bay.

The amount expended on this improvement to June 30, 1908, is $47,337.63, of which $23,976.85 was for maintenance.

The commerce of the river, which is quite varied, is reported for the calendar year 1907 as 63,180 tons, valued at $1,370,900.

As to the effect of the improvement of this stream upon freight rates, it is reported that shipments by water are 25 to 50 per cent lower than by rail, and that in winter, when the boats can not run, the railroad increases its rates.

It is proposed to expend the funds recommended below in dredging the channel to full project dimensions as far as possible and in maintenance work.

July 1, 1907, balance unexpended	$7,837.91
Allotment from emergency appropriation, river and harbor act of March 2, 1907	3,000.00
	10,837.91
June 30, 1908, amount expended during fiscal year for maintenance of improvement	7,163.06
July 1, 1908, balance unexpended	3,674.85
July 1, 1908, outstanding liabilities	20.00
July 1, 1908, balance available	3,654.85
July 1, 1908, amount covered by uncompleted contracts	3,400.00
Amount (estimated) required for completion of existing project	23,264.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(c) *Mispillion River.*—This river is a tidal stream which enters Delaware Bay about 17 miles northwest of Cape Henlopen. It is navigable for about 12 miles. The mouth of the river was greatly obstructed by a flat foreshore without a channel. Vessels could enter and depart only at high water, the tidal range being about 4 feet.

The river from Milford, the head of navigation, to the mouth was improved by the General Government between the years 1879 and 1889, and $17,000 was expended in making a channel 40 feet wide and 6 feet deep at mean low water, and its further improvement was carried on to November, 1906, under a project adopted in the river and harbor act of July 13, 1892. This resulted in a channel 40 feet wide and 4½ feet deep at mean low water from Milford to the mouth and 50 feet wide and 5 feet deep thence to the 5-foot contour in Delaware Bay; and two jetties at the mouth, one, the north jetty, extending from the east bank of the river a length of 1,645 feet, and the other, the south or Green Point jetty, extending from Green Point, just below the mouth of Cedar Creek, a distance of 1,100 feet, 500 feet of the outer end being parallel to and 100 feet distant from the axis of the dredged channel, and 200 feet from the north jetty.

The present project was adopted in the river and harbor act of March 2, 1907, and is based upon the report printed in House Document No. 102, Fifty-sixth Congress, second session. This provides for dredging the channel 6 feet deep at mean low water and 60 feet wide, increasing to 75 feet at sharp turns, from Milford to the mouth and thence 4 feet deep and 150 feet wide across the flats, and the construction of a jetty along the south side of the channel, at an estimated cost of $87,065.

From the appropriation made by the act of March 2, 1907, for improving the Appoquinimink, Murderkill, and Mispillon rivers, Delaware, $40,000 was allotted for the Mispillon, with which an extension has been built to the south jetty, 2,200 feet long, parallel to and 100 feet distant from the axis of the channel, and extending in a southeasterly direction into a natural depth of 2 feet at mean low water on the flats of Delaware Bay; and under a contract for dredging the channel in the river, with the exception of about 200 feet at New Wharf Landing, was dredged to a minimum depth of 6 feet at mean

[a] See consolidated money statement on page 212.

low water and a width of 40 feet, and some shoaling removed at the mouth.

About 35 per cent of the project has been completed.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part under improvement was 5 feet in the river and 2½ feet across the flats at the mouth.

The amount expended to June 30, 1908, is $111,596.03. Of this $33,205.96, is on the present project and no part of which was for maintenance.

The commerce of the river for the calendar year 1907 is reported to have been 229,886 tons valued at $5,226,230.

The effect of the improvement on freight rates is stated to be quite marked, a reduction of an average of 25 per cent being reported, in addition to affording better and increased transportation facilities.

It is proposed to expend the funds recommended below in building 1,700 feet of jetty, completing the south jetty to its project length of 5,000 feet, in dredging the channel within the river and across the flats at the mouth to full project dimensions, and in maintaining the channel for one year after this work is completed.

July 1, 1907, balance unexpended	$39,573.44
June 30, 1908, amount expended during fiscal year for works of improvement	32,779.40
July 1, 1908, balance unexpended	6,794.04
July 1, 1908, outstanding liabilities	2,800.00
July 1, 1908, balance available	3,794.04
July 1, 1908, amount covered by uncompleted contracts	3,000.00
Amount (estimated) required for completion of existing project	47,065.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(*)

CONSOLIDATED.

July 1, 1907, balance unexpended		$53,461.15
Allotment from emergency appropriation, river and harbor act of March 2, 1907		3,000.00
		56,461.15
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$32,779.40	
For maintenance of improvement	11,790.09	
		44,569.49
July 1, 1908, balance unexpended		11,891.66
July 1, 1908, outstanding liabilities		2,820.00
July 1, 1908, balance available		9,071.66
July 1, 1908, amount covered by uncompleted contracts		6,400.00
Amount (estimated) required for completion of existing project		77,729.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		80,225.00

(See Appendix I 11.)

* See consolidated money statement on this page.

12. St. Jones River, Delaware.—Before the channel was improved the least practicable low-water depth of water to Lebanon, 12 miles above the mouth, was 4 feet, and thence to Dover, 9 miles farther up the river, only 2½ feet.

The original project, made in 1880, was for a 3-foot low-water channel, 100 feet wide across the bar at the mouth, protected by a jetty, at an estimated cost of $35,000. The project was modified in 1884 so as to include the removal of shoals in the river to a depth of 6 feet at mean low water. Improvements were not begun until 1885. The proposed channel within the river was reported as nearly completed at the close of the fiscal year ending June 30, 1888, $25,000 having been expended.

A modification of the project for the improvement of the entrance was submitted and approved in March, 1889. This modified project provided for a cut across the bar at the mouth from the 6-foot depth inside the river to the corresponding depth outside the bar, the width of the cut to be 100 feet, of which 50 feet in the center was to be dredged to a depth of 6 feet, the remainder to a depth of 3 feet below mean low water. The material was to be deposited on either side of the cut to form training dikes, the outer ends of the dikes to be strengthened with pile revetments. It also provided for a new cut-off across a very sinuous bend in the upper river about 1 mile below Lebanon, near Wharton's fishery. This was substantially completed in 1890. Subsequent operations have been for maintenance.

With funds provided by general and emergency river and harbor acts, dredging has been done at various times between 1889 and June 30, 1905. A history of these operations will be found in the Annual Report of the Chief of Engineers for 1905, pages 181–182.

Operations with funds provided by the river and harbor acts of March 3, 1905, and March 2, 1907, have resulted in a continuous channel from Lebanon to Delaware Bay of a minimum depth of 6 feet at mean low water and a width of 40 feet in the river and 50 feet across the flats at the mouth.

An allotment of $3,000 has been made from the appropriation for emergencies in river and harbor works, to be applied to the maintenance of the river, and work under contract was begun on June 27, 1908. It is proposed to dredge the channel across the flats just outside the mouth of the river and, as far as the available funds will permit, remove shoals from the channel of the river between the mouth and Lebanon.

The amount expended on the improvement to June 30, 1908, is $60,548.27, of which $19,048.27 was for maintenance.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part from Lebanon to the mouth was 5 feet and across the flats 5 feet.

The commerce of the river for the calendar year 1907 is reported to have been 76,377 tons, valued at $4,809,740. That reported in 1900 was 69,241 tons, valued at $3,569,829. It is stated that the improvements made have reduced freight rates by one-fourth to one-half, besides increasing shipments, especially fruits, which now reach the market in less time and fresher condition.

It is proposed to expend the funds recommended below in maintenance of the present channel.

July 1, 1907, balance unexpended	$2,748.01
Allotment from emergency appropriation, river and harbor act of March 2, 1907	3,000.00
	5,748.01
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,739.78
July 1, 1908, balance unexpended	3,008.23
July 1, 1908, outstanding liabilities	278.91
July 1, 1908, balance available	2,729.32
July 1, 1908, amount covered by uncompleted contracts	2,421.09
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	4,500.00

(See Appendix I 12.)

13. Smyrna River, Delaware.—This river was formerly known as Duck Creek. It is a tidal stream flowing easterly into the Delaware River at a point about 26 miles south of Wilmington, Del. The navigable portion of the river was originally about 9 miles long; the minimum mean low-water depth over shoal places was 2½ feet in the river and 4 feet at the bar where it enters the Delaware River. The mean range of tide at the mouth is nearly 6 feet.

In 1878 a project was made for the improvement of the whole river, including the channel across the bar at the mouth. By direction of Congress the improvement of the bar was commenced first, and during the following four years three appropriations, aggregating $10,000, were expended in dredging a channel 100 feet wide and 8 feet deep at mean low water across the bar. The dredged channel soon filled up again.

A new project was adopted in the river and harbor act of August 11, 1888, with a view of obtaining a channel of 7 feet depth throughout, width of 60 feet in the river and 100 feet at the bar, the channel over the bar to be protected by a stone jetty. The estimated cost of the improvement was $90,698.40. Of this, $37,365.20 was for dredging and $53,333.20 for the jetty. This act made the first appropriation for work on the project and was by its terms to be applied to dredging only. The subsequent appropriations for continuing the improvement have also been applied to dredging.

The entire length of channel has been dredged in parts at various times to the approved dimensions and the project completed.

With an appropriation of $15,000 made by the river and harbor act of June 13, 1902, as modified by the act of March 3, 1905, two cut-offs were made in 1905 extending from just below Limekiln wharf to the turn just above Mill Creek and from the mouth of Mill Creek to the bend above Brick Store wharf, an aggregate length of 4,795 feet.

The sum of $2,500 was allotted from the emergency appropriation made by the river and harbor act of March 2, 1907, and was applied to the restoration of channel depths in Smyrna River, under contract. The channel was dredged to a depth of not less than 7 feet at mean low water and width of 100 feet from inside the river at the mouth to the 7-foot depth in Delaware River.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part of the river was 6 feet and across the flats at the mouth 7 feet.

The amount expended on the improvement to June 30, 1908, is $69,025.47. Of this amount $59,025.47 is on the present project, and of which $13,940.69 was for maintenance.

The commerce for the calendar year 1907 is reported to have been 197,290 tons, valued at $4,914,450.

The effect of the improvement of this river on freight rates has been to reduce them by about 25 per cent, and in addition it has resulted in the saving of time in shipments to Philadelphia and elsewhere. These conditions have stimulated certain industries, especially the fruit culture, and largely increased the production in this section.

Reference to reports on examination and survey made in pursuance of act of March 2, 1907, will be found on page 217 of this report.

It is proposed to expend the appropriation recommended below in maintenance of the existing channel.

July 1, 1907, balance unexpended	$1,976.53
Allotment from emergency appropriation, river and harbor act of March 2, 1907	2,500.00
	4,476.53
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,194.37
July 1, 1908, balance unexpended	2,282.16
July 1, 1908, outstanding liabilities	2,183.76
July 1, 1908, balance available	98.40
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	6,500.00

(See Appendix I 13.)

14. Broadkill River, Delaware.—In its original condition the depth of water in the river was from 3 to 4 feet at the numerous shoals which impeded navigation. The depth at the mouth was from 1½ to 2 feet at low water.

Prior to the adoption of the existing project $35,000 was expended in providing a channel within the river 6 feet deep and 40 feet wide at low water from the mouth to Milton, the head of navigation.

The existing project was adopted in the river and harbor act of March 2, 1907, and is based upon report and estimate submitted in House Document No. 214, Fifty-ninth Congress, second session. It provides for the establishment of a permanent entrance at the mouth of the river by dredging a channel from the 6-foot curve in Delaware Bay to the same depth in the river and constructing a jetty on the north side of this channel. A small gap is to be left in the jetty for use by vessels and to permit circulation. The estimated cost of the project is $33,330.

The range of the tide is 4.1 feet at the mouth, 3.6 feet at the drawbridge, and 3.4 feet at Milton.

The act of March 2, 1907, appropriated $33,330, the amount estimated for the establishment of a permanent entrance at the mouth of the river and the construction of a jetty on the north side of the channel, and the title papers conveying to the United States the land required for the cut to be made across Lewes Cape have been approved by the Department of Justice. To the close of the fiscal year, the section of jetty extending from the high-water line of Delaware Bay to the low-water line of Lewes Sound had been completed, and work on the section extending into Delaware Bay was well advanced, the channel to be dredged across the cape had been made 150 feet wide and 6 feet deep at mean low water for a length of 250 feet, and a further length of 117 feet, 45 feet wide and 6 feet deep at mean low water. This work was done under contract.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part of the river under improvement was 3 feet from Milton to the mouth and 2 feet across the bar at the old mouth.

The amount expended on the improvement to June 30, 1908, is $42,660.27. Of this, $7,660.27 was on the present project, no part of which was for maintenance.

It has been impracticable to obtain statistics of shipments by water alone or the tonnage during the calendar year 1907, but it is reported that the value of shipments to Milton by rail and water was $1,983,000 and from Milton $1,591,200.

The dredging of a channel from Lewes Creek to Broadkill River and the closing of the present mouth of Lewes Creek, provided for in the project, are now being performed by private enterprise under the authority of the Secretary of War. This eliminates from the project these two items, which were estimated at $10,210. In view of the fact, however, that the price obtained for the dredging now in progress is 4.2 cents per cubic yard in excess of that estimated, it is not deemed advisable to recommend at present a reduction in the approved estimate for completion of the project.

It is proposed to expend the funds recommended below in maintaining the channel at the mouth of the river.

Since the date of preparation of this report work under the approved project has been practically completed. Although it is too soon to state definitely what the final results from the action of the single north jetty will be, the effects of recent storms would tend to indicate that the south jetty mentioned in House Document No. 214, Fifty-ninth Congress, second session, will be necessary to protect and hold a stable channel at the mouth of Broadkill River. From experience in construction of the existing north jetty, and on account of known changes in quantities and prices, as well as altered physical conditions, it is estimated by the local officer now in charge that a suitable south jetty will cost $21,000. It is recommended that funds for the construction of this south jetty be made available by Congress, to be expended in the discretion of the Secretary of War.

July 1, 1907, balance unexpended	$33,254.46
June 30, 1908, amount expended during fiscal year for works of improvement	7,584.73
July 1, 1908, balance unexpended	25,669.73
July 1, 1908, outstanding liabilities	3,050.00
July 1, 1908, balance available	22,619.73
July 1, 1908, amount covered by uncompleted contracts	21,900.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	2,500.00

(See Appendix I 14.)

15. Removing sunken vessels or craft obstructing or endangering navigation.—During the past fiscal year wrecks were removed as follows:

Wreck of an old sailing vessel (name unknown) and barge, lying sunk in the upper Christiana River, Delaware. Cost, $359.81.

Wreck of a stone barge, lying sunk at the mouth of the Brandywine River, Delaware. Cost, $140.65.

The expenditures during the year amounted to $500.46.

(See Appendix I 15.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of Little River, Delaware, from the mouth of the same to the town of Little Creek.—Report dated May 6, 1907, is printed in House Document No. 78, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

2. Preliminary examination and survey of Toms River, New Jersey, with a view to obtaining 5 feet of water on shoals near village of Toms River.—Reports dated May 6 and October 16, 1907, are printed in House Document No. 346, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $10,050 is presented.

3. Preliminary examination and survey of Forked River, New Jersey, from its mouth to the town of Forked River, with a view to obtaining a depth of 5 feet.—Reports dated April 24 and October 16, 1907, are printed in House Document No. 403, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

4. Preliminary examination and survey of Smyrna River, Delaware.—Reports dated May 2 and December 11, 1907, respectively, are printed in House Document No. 815, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $89,000 is presented.

5. *Preliminary examination and survey for canal to connect Rehoboth Bay with Delaware Bay at or near Lewes, Del., through Lewes Creek and Gordon Lake.*—Reports dated May 17, 1907, and January 17, 1908, respectively, are printed in House Document No. 823, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $356,000 is presented.

6. *Preliminary examination and survey of Cat River, Virginia, with a view to obtaining a deeper channel.*—Reports dated June 12, 1907, and April 11, 1908, respectively, are printed in House Document No. 957, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $12,100 is presented.

The local officer was also charged with the duty of making other preliminary examinations and surveys, provided for in the river and harbor act of March 2, 1907, as follows, and reports thereon will be duly submitted when received:

1. *Oldmans Creek, New Jersey.*
2. *St. Jones River, Delaware, from its mouth to Dover.*

IMPROVEMENT OF RIVERS AND HARBORS IN THE BALTIMORE, MARYLAND, DISTRICT.

This district was in the charge of Col. R. L. Hoxie, Corps of Engineers. Division engineer, Col. D. W. Lockwood, Corps of Engineers.

1. *Patapsco River and channel to Baltimore, Md.*—Before operations were begun by the United States a controlling depth of 17 feet was available, with a mean range of tide of a little over 1 foot. Vessels over that draft were obliged to lighter portions of their cargoes about 14 miles below to permit them to reach the wharves of the city. There were pockets where deeper water prevailed, but these were unconnected by any channel, natural or artificial. Under the original project, dated April 15, 1853, for a channel 22 feet deep at mean low water and 150 feet wide, the Fort McHenry channel was dredged, extending from the limits of the city of Baltimore to a point just below Fort Carroll, and the Brewerton channel from this point to deep water of Chesapeake Bay off Swan Point. The cost was $390,000.

In 1871 the project was enlarged to a width of 400 feet at the lower end of the channel, diminishing to 250 feet at its upper end, with a mean low-water depth of 24 feet. Meantime it had been found that the portion of the Brewerton channel which was swept across by the current of the Susquehanna River was continually obstructed by sedimentary deposit. This led to a search for a better location for a deep channel which could be made and maintained by dredging and the natural currents. This was found in the position of the resultant of the two great forces made by the currents of the Susquehanna and Patapsco rivers. The new channel had also the advantage of being shorter by several miles, and for this reason and the very much diminished sedimentary deposit the cost of maintenance was much lessened. In 1892 a project for 27 feet depth at mean low water, with a width of 600 feet in the straight sections and over 1,200 feet in the angles, was completed. At the same time the portion of the Brewerton channel between the upper end of the present cut-off and the point of intersection of the Brewerton and Craighill channels was

abandoned because of the sedimentary deposit from the Susquehanna sweeping across it and to shorten the channel still further and lessen the cost of maintenance. The act of June 3, 1896, authorized the increase of the depth of the channel to 30 feet at mean low water, with a bottom width of 600 feet, widened at the angles, and with side slopes of 3 base to 1 vertical. This was completed May 22, 1903, and has since been maintained. The amount expended on original and modified projects prior to operations under existing project is $4,721,269.48, of which $32,797.72 was for maintenance.

The existing project, adopted by Congress March 3, 1905, provides for a channel 35 feet deep at mean low water and 600 feet wide at bottom, with side slopes of 3 base to 1 vertical from Fort McHenry to deep water in Chesapeake Bay above Sandy Point light-house and through the shoals opposite York Spit, at an estimated cost of $3,465,000. Dredging began July 5, 1905, and resulted in a depth of 35 feet for a width of 300 feet in the section near Baltimore, and a varying depth of from 31 feet to 35 feet for a width of 300 feet in the section opposite York Spit. An appropriation of $500,000 was made in the river and harbor act of March 2, 1907, and work was authorized under continuing contracts for completion to an additional amount of $1,715,000. Proposals for this work were opened July 1, 1907, and a continuing contract made for completing the project. Work under contract has been in progress during the fiscal year with the result that the section near Baltimore is nearly completed and will be entirely so in the coming autumn. The eastern half (or 300-foot width) of York Spit channel is nearly completed, and is expected to be entirely so in the coming August. The sum of $965,000 asked for is the balance of $1,715,000 authorized in act of March 2, 1907, and is intended to be applied to completing project.

The amount expended on the existing project to the close of the fiscal year ending June 30, 1908, is $1,561,174.20 and $18,065.14 for filling in swamps at Fort Howard, Md., of which $1,234.81 has been repaid, leaving $16,830.33 still due.

The draft that can now be carried to Baltimore, the head of navigation, a distance of 11 miles from the mouth of Patapsco River and 171 miles from the mouth of Chesapeake Bay, is 35 feet at mean low water. The length of dredged channel in Patapsco River and Chesapeake Bay above Sandy Point is about 20 miles; opposite York Spit, about 4½ miles.

The tonnage movement of the port has been as follows:

Fiscal year ending June 30—	Tons.	Fiscal year ending June 30—	Tons.
1889	3,243,017	1899	6,843,620
1890	4,237,361	1900	7,941,580
1891	4,495,469	1901	8,055,017
1892	5,224,042	1902	7,529,870
1893	4,607,176	1903	7,736,447
1894	4,752,946	1904	7,334,241
1895	4,794,964	1905	7,510,713
1896	5,363,894	1906	8,277,098
1897	6,868,120	1907	8,448,203
1898	7,339,405	1908	8,441,034

The statistics of the port for the past fiscal year are illustrated briefly by the following table:

Dutiable imports have decreased	$4,068,778
Free imports have decreased	$4,223,117
Domestic exports have decreased	$14,726,083
Tonnage (foreign and coastwise) has decreased ... tons	7,169
Duties collected have decreased	$397,944.56
Duties on merchandise in bond have increased	$28,804.22
Duties on merchandise in bond with and without appraisement have increased	$940,880.12

The effect of the present project upon freight rates can not be ascertained until work is completed, but as some of the vessels trading with the port are not now able to load to their full capacity the tendency should be toward cheapening rates when means are provided to enable them to carry full cargoes and to enable other vessels of greater capacity to trade with the port.

References to reports of examinations and surveys are to be found on page 180 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1907, balance unexpended		$980,128.12
Amount appropriated by sundry civil act approved May 27, 1908		750,000.00
June 30, 1908, amount repaid on account filling in swamps at Fort Howard, Md		1,234.81
		1,731,362.93
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$771,541.80	
For filling in swamps at Fort Howard, Md	18,065.14	
		789,606.94
July 1, 1908, balance unexpended		941,755.99
July 1, 1908, outstanding liabilities		1,049.32
July 1, 1908, balance available		940,706.67
July 1, 1908, amount covered by uncompleted contracts		914,344.20
Amount (estimated) required for completion of existing project		965,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897.		965,000.00

(See Appendix J 1.)

2. Channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland.—With a mean range of tide of a little over 1 foot, there was a controlling depth of 20 feet at mean low water in 1893, when the first improvement was undertaken by the United States. The original project was dated July 15, 1892, and was for a channel 27 feet deep at mean low water and a bottom width of 150 feet, at an estimated cost of $85,000. Forty thousand dollars of the estimate was appropriated, and with this total expenditure the channel was first made 25 feet deep for the project width and then dredged to 27 feet depth for a width of 70 feet in the axis of the 150-foot channel. That project never was completed. It was superseded by a project in the river and harbor act approved June 13, 1902, for deepening the channel to 30 feet and widening it to 250 feet, and authority was granted to make continuing contracts to complete the work. The estimated cost was $196,000.

A continuing contract was approved, and under it dredging was commenced March 5, 1903, and the project completed November 30, 1903.

The amount expended on existing project to June 30, 1908, was $196,000, of which $3,316.64 was used during the past fiscal year for maintenance in partially removing some shoaling. This was done under contract. The sum of $9.000 more is required to entirely remove shoals and place material behind bulkheads.

Curtis Bay is the mouth of Curtis Creek, which is navigable in fact 5⅛ miles above the head of the channel contemplated by the existing project, but a maximum draft of 28½ feet at mean low water can be carried June 30, 1908, over the shoalest part of the locality under improvement, which is a distance of 2⅛ miles.

It is stated that the improvement has lowered rates upon freight, but the amount of reduction has not been ascertained.

References to reports on examinations and surveys are to be found on page 180 of the Annual Report of the Chief of Engineers for 1904.

This bay is in the collection district of Baltimore and the statistics are attached to the report for that harbor.

July 1, 1907, balance unexpended	$3,316.64
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,316.64
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	9,000.00

(See Appendix J 2.)

3. Harbor of southwest Baltimore (Spring Garden), Md.—No work was done by the United States before the existing project, but the city of Baltimore dredged a channel from the main ship channel to the foot of Eutaw street, which had a controlling depth of 15 feet at mean low water. The average rise of the tide is a little over 1 foot. In response to a resolution of the House of Representatives an estimate was furnished March 7, 1896 (printed in Annual Report for 1896, p. 1006), of the cost of deepening the channel to a depth of 27 feet. It was for a channel 100 feet wide on the bottom, with side slopes of 1 on 3, from the main ship channel near Fort McHenry to the foot of Eutaw street, with a turning basin 400 feet by 400 feet near the upper end, at an estimated cost of $314,000, which is the existing project. Five thousand dollars was appropriated June 3, 1896, but it was deemed inexpedient to start the work with that small sum. June 13, 1902, $88,000 was appropriated and authority granted to enter into contracts for the completion of the work. A continuing contract was made for the completion of the project, and it was completed April 4, 1905. The sum of $314,000 was expended under the project for improvement, in addition to which $6,500 was expended during the year just past for maintenance.

The work of the year was for the partial removal of extensive shoals, under contract. The sum of $53,000 more is required to entirely remove shoaling and place material behind bulkheads. This channel was dredged in very soft material, where silt has been slowly accumulating for many years. The cost of maintenance for a number of years will probably continue to be large, but after the side slopes

have flattened out sufficiently it is thought that the cost of maintenance will be much reduced.

The maximum draft that can be carried June 30, 1908, at mean low water over the shoalest part of the locality under improvement is 27 feet at the lower end and about 16 feet at the upper end.

The stream is navigable in fact to Baltimore, Md., which is 14 miles from the mouth of Patapsco River and 174 miles from the mouth of Chesapeake Bay. The length of the channel dredged under the existing project is 4 miles. It is stated that the improvement has somewhat lowered freights, but the amount of reduction has not been ascertained.

The commercial statistics of the port of Baltimore include this harbor.

July 1, 1907, balance unexpended	$6,500.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	6,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	53,000.00

(See Appendix J 3.)

4. Elk River, Maryland.—Before improvements were commenced there was practically no navigation above Cedar Point. The original project, dated June 23, 1874, was for a channel 6 feet deep at low water, or 8 feet at high water, from Cedar Point to Elkton, the head of navigation, and in the Little Elk as far as Bennett's wharf. The mean range of the tide is 2 feet. Such a channel was estimated to cost $36,000 if 75 feet wide and about $25,000 if 50 feet wide, cheap dikes being required for regulating the banks and to provide a place behind which to deposit the material dredged from the shoals. The first work was done in 1874, when $5,000 was expended in building a dike and dredging to a width of 25 feet and a depth of 6 feet at mean low water in front of it and for about 300 feet below. Two years later the channel was made 40 feet wide from the bridge at Elkton to about one-half mile below. In 1884 a channel was completed 80 feet wide through the bar near the mouth of the Little Elk River and 70 feet wide thence to the bridge at Elkton, the depth being 7 feet at mean low water. In 1893 a channel 100 feet wide and 8 feet deep from deep water below Cedar Point to the bridge at Elkton was completed. The expenditure on the original and subsequent projects has amounted to $46,500.

The channel had shoaled, and in a report on a survey made in 1899 (printed on pp. 1668–1669, Pt. 2, Annual Report of the Chief of Engineers for 1900) it was proposed to restore the channel to 8 feet depth at mean low water and 100 feet wide from deep water below Cedar Point to the bridge at Elkton, at an estimated cost of $16,665, with an annual cost of $2,500 for maintenance. The river and harbor act of June 13, 1902, adopted this project, and appropriated $16,665 for the work. This appropriation was practically expended in dredging in the fiscal year ending June 30, 1903. The project width of 100 feet could not be made, as the river was found to have shoaled very much since the survey in 1899, on which the appropriation was based.

The existing project adopted by the river and harbor act of March 2, 1907, is for a channel 6 feet deep at mean low water and 100 feet wide from Elkton to Cedar Point, at an estimated cost of $16,802.77. The act appropriated $18,803 for its completion and maintenance. A contract was entered into and the project completed in March of this year. Nevertheless extensive shoaling has already taken place and it is doubtful whether the project can be maintained without annual dredging to an extent much greater than was anticipated. The sum of $10,000 is now required.

The amount expended on this improvement to June 30, 1908, is $82,197.33, of which $63,165 was on previous projects, $14,668.57 on present project, and $4,363.76 for maintenance.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the river was 3½ feet. The stream is navigable, in fact, to Elkton, Md., which is about 16 miles from the mouth of the river. It was stated that the improvement was not completed in time to show any effect upon freight rates.

Reference to a report on a survey is to be found on page 182 of the Annual Report of the Chief of Engineers for 1904. Reference to report on preliminary examination and survey of the river, required by the river and harbor act of March 3, 1905, will be found on page 214 of the Annual Report of the Chief of Engineers for 1906.

The commerce of the river for the calendar year 1907 is reported to be 30,357 tons, valued at $230,057. Two steam tugs and fifty schooners and barges are reported as plying in the river.

July 1, 1907, balance unexpended		$18,802.09
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$14,668.57	
For maintenance of improvement	2,362.85	
		17,031.42
July 1, 1908, balance unexpended		1,770.67
July 1, 1908, amount covered by uncompleted contracts		1,738.18
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899		

(See Appendix J 4.)

5. Susquehanna River above and below Havre de Grace, Md.—The original governing depth was 5 feet at mean low water. The mean range of tide is 2½ feet. The channel above Havre de Grace was narrow and subject to ice gorges. The original project is dated February 22, 1853, and was for a channel 12 feet deep and 100 feet wide, at an estimated cost of $59,000. Improvements have been in progress since 1853, and up to August 22, 1882, when the existing project was adopted, $97,390 had been expended upon them. The existing project is to give a channel 200 feet wide and 15 feet deep at mean low water below Havre de Grace and to remove the shoal opposite Watson Island (which is above Havre de Grace) to a depth of 8 feet at the same stage of the tide, at an estimated cost of $168,000. The amount expended on that project to June 30, 1908, is $93,530.03, and has resulted in dredging a portion of the channel below Havre de Grace to a depth of 15 feet at mean low water and removing the shoal oppo-

site Watson Island, completing about one-half of the approved project.

There were no operations during the past year, but a contract for dredging has been entered into and will be executed during the next fiscal year.

The maximum draft that can be carried June 30, 1908, at mean low water over the shoalest part of the channel under improvement is 11 feet. The stream is navigable in fact to Port Deposit, Md., which is about 5 miles above the mouth of the river. The improvement has made no appreciable difference in freight rates. It is proposed to apply funds asked for in continuing project.

Three steamers and 65 sailing vessels and barges are reported as plying in the river, the commerce being valued at $801,420. The tonnage of the river is reported to be as follows: 1905, 135,293; 1906, 73,815; 1907, 85,212.

July 1, 1907, balance unexpended	$20,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	30.03
July 1, 1908, balance unexpended	19,969.97
July 1, 1908, amount covered by uncompleted contracts	18,000.00
Amount (estimated) required for completion of existing project	54,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	20,000.00

(See Appendix J 5.)

6. Harbors at Rockhall, Queenstown, Claiborne, and Cambridge, and Chester, Choptank, Warwick, Pocomoke, La Trappe, and Manokin rivers, and Tyaskin Creek, Maryland.—(a) Rockhall Harbor and inner harbor at Rockhall.—In 1894 the controlling depth at Rockhall Harbor was 5 feet, with an average range of tide of 1.1 feet. With an appropriation of $16,000 made June 3, 1896 (the first for this work), a project was carried out in 1897–98 for dredging a cut 80 feet wide and 10 feet deep at mean low water from the 10-foot curve in Swan Creek Inlet to the 10-foot depth in Chesapeake Bay, and a channel 100 feet wide and 10 feet deep from that depth in Swan Creek Inlet to the old pier at Rockhall. A turning basin, embracing the old and new piers, was also dredged.

In accordance with the river and harbor act of March 3, 1899, an examination was made of Rockhall Harbor and the inner harbor at Rockhall, report on which is printed in the Annual Report of the Chief of Engineers for 1900, pages 1670–1672. The project then proposed is dredging a channel 12 feet deep and 150 feet wide from Chesapeake Bay to Swan Creek Inlet, across Swan Point bar, and 12 feet deep and 150 feet wide from Swan Creek Inlet to the wharf at Rockhall at a cost estimated in 1899 to be $43,065, and $9,208 every two years for maintenance.

The river and harbor act of June 13, 1902, adopted this project, which is the existing one. The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $14,383.97 was allotted for this work.

A contract for expenditure of funds has been entered into, and dredging was begun near close of fiscal year.

The channel across Swan Point bar is practically obliterated, no funds being available for maintenance since the channel was originally dredged. It is questionable whether the channel at this point can be maintained at reasonable cost, and it may be necessary to abandon it and make a detour to the southward so as to avoid this bar. The unit price of dredging has exceeded that assumed in the original estimate. The estimated cost of project was increased May 13, 1907, to $60,386.81.

The amount expended on this improvement to June 30, 1908, is $41,573.73, of which $16,597.12 was on a previous project and $537.54 for maintenance, consisting in the removal of a shoal in the inner harbor.

About two-fifths of the project has been completed. It is proposed to apply all funds to continuing the project.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the channel across Swan Point bar is about 4 feet and in the inner harbor 12 feet, to which point the improvement is navigable in fact. The harbor is a bay making in from Chesapeake Bay and is navigable in fact to Rockhall pier, which is about one-fourth mile above the mouth of Rockhall Harbor.

In 1905 over 50 vessels of from 5 to 50 tons made this harbor their headquarters, and steamers made a daily service from Baltimore, their course from Baltimore being down the bay and around the south end of Swan Point bar to the inner harbor at Rockhall.

It is impracticable to procure commercial statistics for 1907, the last received, those for 1905, being reported at $388,811.

It is stated that the improvement has had no appreciable effect on freight rates.

July 1, 1907, balance unexpended	$14,377.31
June 30, 1908, amount expended during fiscal year for works of improvement	137.72
July 1, 1908, balance unexpended	14,239.59
July 1, 1908, outstanding liabilities	7.62
July 1, 1908, balance available	14,231.97
July 1, 1908, amount covered by uncompleted contracts	12,945.58
Amount (estimated) required for completion of existing project	21,711.03
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	(a)

(b) *Queenstown Harbor.*—Before 1871 the controlling depth in this harbor was 6 feet, with a range of tide of about 2 feet. Between that year and 1880 it was improved under a project dated January 2, 1871, and a channel 100 feet wide at bottom and 8 feet deep at mean low water was made. In 1897, with $5,000 appropriated for continuing the improvement, a channel was dredged to 8½ feet at mean low

[a] See consolidated money statement on page 235.

water and 100 feet wide from Chester River to the inner harbor, to which point the bay is navigable in fact, and in 1900 a shoal extending from a point 138 feet above the lower light down for a distance of 950 feet was dredged to a depth of 8 feet and a width of 80 feet.

The river and harbor act of June 13, 1902, provided that the improvement should be made in accordance with the report submitted and printed in the Annual Report of the Chief of Engineers for 1900, pages 1673–1676. The project therein submitted contemplates increasing the dimensions of the channel so as to make them 10 feet deep and 200 feet wide, at an estimated cost of $23,100.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $4,975.70 was allotted for this work.

A contract for expenditure of funds was entered into and dredging completed in the winter of 1907, advancing the project to that extent. Funds asked for are intended to continue the project. Owing to insufficient appropriations, the work has been prolonged and the cost of maintenance is added to the original estimate. The unit price of dredging has exceeded that in the original estimate. The estimated cost of project was therefore increased May 13, 1907, to $25,886.35.

The amount expended on this improvement to June 30, 1908, is $39,861.05, of which $19,557.80 was on the existing project, and $1,303.25 for maintenance. About three-fourths of the project has been completed.

The entire channel has been dredged to a depth of 10 feet, but the maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the locality under improvement was 8½ feet.

Six steamers and 175 sailing vessels and barges are reported to ply in the harbor. The tonnage of the harbor is reported to be as follows: 1900, 12,373; 1901, 11,328; 1902, 18,769; 1903 (only partial statistics could be obtained), 3,889; 1904, 19,144; 1905, 19,421; 1906, 19,808; 1907, 20,202, valued at $1,063,540.

The harbor is a bay making from the Chester River and is navigable in fact to Queenstown, which is about one-half mile above mouth of harbor. The improvement has made no perceptible difference in freight rates.

July 1, 1907, balance unexpended		$4,975.70
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$2,951.30	
For maintenance of improvement	1,303.25	
		4,254.55
July 1, 1908, balance unexpended		721.15
July 1, 1908, amount covered by uncompleted contracts		447.50
Amount (estimated) required for completion of existing project		5,607.40
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908		([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(*c*) *Claiborne Harbor.*—Claiborne is on the eastern shore of Chesapeake Bay, about 6 miles east from Bloody Point light-house. No

[a] See consolidated money statement on page 235.

improvement there had ever been made by the United States previous to the existing project. The controlling depth was 9 feet at mean low water with a mean range of tide of about 2 feet.

The act of June 13, 1902, adopted the existing project, which provides for dredging a channel 12 feet deep at mean low water and 300 feet wide from the 12-foot contour in Eastern Bay to the railroad pier in the harbor, a distance of about 1,900 feet, and thence shoreward along the south side of the pier to a width of 195 feet for a length of 500 feet, at an estimated cost of $17,490, and a further sum of $2,500 for an extension of the existing jetty, should it be found necessary.

A 12-foot depth at mean low water was dredged with variable widths in the fiscal year ending June 30, 1904. The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $3,440.24 was allotted for this work. A contract for expenditure of funds was entered into and dredging finished in the spring of 1908, which resulted in restoring the channel to dimensions left in 1905. Funds asked for are for completion of project. About three-fifths of the project has been completed.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the channel is 11 feet. The amount expended to June 30, 1908, is $19,993.10, of which $4,993.10 was for maintenance.

Owing to insufficient appropriations the work has been prolonged and the cost of maintenance is added to the original estimate. The unit price of dredging has exceeded that in the original estimate. The estimated cost of project was therefore increased May 13, 1907, to $27,408.30.

Claiborne is at the head of navigation in Claiborne Harbor, and is the western terminus of the Baltimore, Chesapeake and Atlantic Railway. It is about one-half mile from the mouth of the harbor.

Three steamers and 71 sailing vessels and barges are reported to ply in the harbor.

The tonnage of the harbor is reported to be as follows: 1903, 89,549; 1904, 90,435; 1905, 93,603; 1906, 91,957; 1907, 93,794, valued at $7,250,456. The improvement has made no appreciable difference in freight rates. Reference to a survey is to be found on page 185 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1907, balance unexpended	$3,440.24
June 30, 1908, amount expended during fiscal year, for maintenance of improvement	3,129.75
July 1, 1908, balance unexpended	310.49
July 1, 1908, amount covered by uncompleted contracts	308.90
Amount (estimated) required for completion of existing project	12,097.81
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

[a] See consolidated money statement on page 235.

(*d*) *Cambridge Harbor.*—This harbor is on the eastern side of the Choptank River, about 20 miles above its mouth, and Cambridge is the head of navigation at the mouth of the harbor. In 1870, before operations were commenced, there was a controlling depth of 4 feet, with a mean range of tide of about 1.7 feet. The improvement of the harbor was commenced in 1871 with a project submitted in March of that year for an entrance way of 100 feet in width and to provide sufficient harbor accommodations of a depth of 10 feet at mean low water. The estimated cost was $36,000. The sum of $10,000 was appropriated March 3, 1871, and work begun. On this and succeeding projects $50,237 was expended to June 30, 1896, resulting in a channel 150 feet wide and 12 feet deep at mean low water from that depth in the Choptank River to the railroad wharf, a distance of nearly a mile. The inner harbor below the bridge had been dredged over its whole irregular area to a depth of 10 feet, and the part of the harbor above the bridge for a distance of 750 feet had been dredged to a depth of 8 feet and a width of 215 feet. A survey was made in 1896 (printed in Annual Report of the Chief of Engineers for 1897, p. 1297), and the improvements then recommended were for a 12-foot low-water channel 150 feet wide from the 12-foot curve in the Choptank River to a point 500 feet outside the Baltimore, Chesapeake and Atlantic Railway Company's steamboat wharf, and from this point gradually widening to the harbor line at the wharf; from the steamboat wharf to Mill wharf to increase the width an average of 200 feet, with a depth of 8 feet, making an anchorage basin; increasing the width of the lower harbor 40 feet on the north side and widening the upper harbor an average of 360 feet along the channel already dredged to a depth of 8 feet. The estimated cost of the project was $8,120. It is the existing one.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $1,531.63 was allotted for this work. A contract for expenditure of funds was entered into and dredging under it finished in the summer of 1907, resulting in advancing part of the 8-foot project and removing some shoals in the 12-foot part of the project.

The amount expended on this improvement to June 30, 1908, is $57,700.32, of which $50,237 was on previous projects and $244.76 for maintenance.

Owing to insufficient appropriations the work has been prolonged and the cost of maintenance is added to the original estimate. The estimate of cost of project was increased May 13, 1907, to $13,858.25. The project is about five-eighths completed. All funds are intended to be applied to continuation and maintenance of the project.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the channel below the bridge was 10 feet, and about 8 feet above as far as the channel has been dredged.

Six steamers and 132 sailing vessels and barges are reported to ply in the harbor, the commerce being valued at $8,796,912. The tonnage of the river is reported to be as follows: 1903, 101,552; 1904, 102,568; 1905, 103,697; 1906, 101,662; 1907, 103,693. The improvement has made no appreciable difference in freight rates.

July 1, 1907, balance unexpended		$1,531.63
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$1,097.76	
For maintenance of improvement	244.76	
		1,342.52
July 1, 1908, balance unexpended		189.11
July 1, 1908, amount covered by uncompleted contracts		137.56
Amount (estimated) required for completion of existing project		6,450.58
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

(*e*) *Chester River, Maryland, from Crumpton to Jones Landing.*—Before operations were undertaken on this part of the river vessels at low tide drawing 6 feet of water could reach Crumpton, 33 miles above the mouth, and from that point to Jones Landing (to which point the stream is navigable in fact), 6¼ miles, the controlling depth was 3 feet, with a mean range of tide of 1.2 feet. The project for improvement, adopted by the river and harbor act of September 19, 1890, is for a 6-foot low-water channel from Crumpton to Jones Landing, at an estimated cost of $12,750, increased in 1896 to $14,250, and still later to $19,562.50. There has been but one project for this section of the river.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Cheasapeake Bay, and $2,417.36 was allotted for this work. A contract for expenditure of funds for maintenance was entered into and dredging for maintenance under it finished in the winter, restoring project dimensions from Crumpton to Ford's wharf.

The amount expended on this improvement to June 30, 1908, is $23,012.06, of which $5,604.88 was for maintenance. The project is completed.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the river was 5 feet.

Six steamers and 175 sailing vessels and barges are reported to ply in the river, the commerce being valued at $3,561,122. The tonnage of the river is reported to be as follows: 1906, 48,199; 1907, 49,162. The improvement has made no appreciable difference in freight rates.

It is proposed to apply funds asked for to removing shoals that have formed in the channel since it was dredged.

July 1, 1907, balance unexpended	$2,417.36
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,165.06
July 1, 1908, balance unexpended	252.30
July 1, 1908, amount covered by uncompleted contracts	216.54
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

[a] See consolidated money statement on page 235.

(*f*) *Choptank River, Maryland.*—Before improvements were begun in 1879 the depth of water in the channel between Denton and Greensboro varied from 2 to 8 feet, with a mean range of tide of about 2 feet. Navigation, carried on by small sailing vessels, extended to only 3 miles above Denton. Upon the remaining 5 miles to Greensboro, the head of navigation, all freight had to be transported upon scows. Greensboro is about 46 miles above the mouth of the river.

A project for improvement was made in 1880 for an 8-foot low-water channel 75 feet wide, at an estimated cost of $79,000. At the close of the fiscal year 1903 the project channel had been completed, except for a distance of about 1 mile at the upper end, but there has been some shoaling since.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $9,662.55 was allotted for this work. A contract for expenditure of funds was made and dredging under it completed last spring and resulted in completing the project except for a distance of about 1,200 feet. About one twenty-fifth of the project remains to be done.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the channel under improvement was 6 feet.

The amount expended on this improvement to June 30, 1908, was $79,102.27, of which $4,344.69 was for maintenance.

Six steamers and 251 sailing vessels and barges are reported as plying in the river, the commerce being valued for the past year at $16,130,830. The tonnage of the river is reported to be as follows: 1903, 208,367; 1904, 210,447; 1905, 212,725; 1906, 208,496; 1907, 212,661. The improvement has made no appreciable difference in freight rates.

It is proposed to apply the funds asked for to completing the project.

July 1, 1907, balance unexpended		$9,662.55
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$7,368.37	
For maintenance of improvement	848.90	
		8,217.27
July 1, 1908, balance unexpended		1,445.28
July 1, 1908, amount covered by uncompleted contracts		868.98
Amount (estimated) required for completion of existing project		2,797.14
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908		(*)
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(*g*) *Warwick River, Maryland.*—This river, formerly named Secretary Creek, is in Dorchester County, eastern shore of Maryland, and flows into the Choptank River, one of the largest tributaries of Chesapeake Bay. It is a small tidal basin 2 miles long, with no fresh-water influx at the head, and was originally only 4 feet deep. The average

* See consolidated money statement on page 235.

rise of tide is 2 feet. The original project for the stream is dated January 20, 1880.

Before the adoption of the present project about $12,000 had been expended in the improvement of this river—$6,000 by the General Government and the remainder by private parties. The existing project for improvement, based upon a survey in 1891 (printed in Annual Report of the Chief of Engineers for 1891, p. 1219) and adopted by the river and harbor act of July 13, 1892, provides for a channel 100 feet wide and 10 feet deep at mean low water from the 10-foot depth in Choptank River to Secretary Landing, at the head of the river, including a turning basin at the latter point, at an estimated cost of $18,600. The project was completed in July, 1903, but shoals formed rapidly.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $3,493.87 was allotted to this work. A contract was entered into and the dredging finished under it in the summer of 1907, restoring the project dimensions from the turning basin to Cedar Point. Funds asked for are intended to be applied to maintenance.

The amount expended on present project to June 30, 1908, is 20,831.82, of which $4,791 was for maintenance. The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the channel under improvement was 9 feet.

Six steamers and 80 sailing vessels and barges are reported as plying in the river, the commerce being valued at $3,129,022. The tonnage of the river is reported to be as follows: 1903, 65,206; 1904, 65,858; 1905, 66,631; 1906, 60,027; 1907, 61,225.

The improvement has made no appreciable difference in freight rates.

July 1, 1907, balance unexpended	$3,493.87
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,922.82
July 1, 1908, balance unexpended	571.05
July 1, 1908, amount covered by uncompleted contracts	313.27
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	(*)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*h*) *Pocomoke River, Maryland.*—This river has been under improvement by the General Government since 1878, the original project being dated November 19, 1878. In 1879 and 1880, $12,500 was expended on work below Snow Hill, chiefly in the rectification of the channel and in giving increased width, the depth being 7 feet at mean low water. In 1888, with an appropriation of $8,000, a cutoff was made through the low neck of land forming four abrupt bends just below Snow Hill. At the close of these operations there was a channel not less than 80 feet wide and 7 feet deep between Snow Hill and Shad Landing, a distance of about 4½ miles.

The existing project adopted by the river and harbor act of June 3, 1896, is based upon a survey made in 1894–95 (printed in Annual

* See consolidated money statement on page 235.

Report of the Chief of Engineers for 1895, p. 1167) and is for dredging the channel between Snow Hill and Shad Landing to a depth of 9 feet at mean low water and a width of from 100 to 130 feet, at an estimated cost of $14,000. The mean range of tide is 2½ feet. Snow Hill is the head of navigation on this stream and is about 28 miles above the mouth. With funds provided from 1897 to 1904 the channel was dredged to the project dimensions.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay and $2,298.60 was allotted to this work. A contract for expenditure of funds for maintenance was made and dredging under it finished in June, 1908, removing three shoals.

To the end of the fiscal year $35,122.25 has been expended for the improvement of this river, of which $20,500 was on previous projects and $351.52 for maintenance. The project is completed, and the additional work required is for maintenance.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the channel under improvement was 7 feet.

Three steamers and 88 sailing vessels and barges are reported as plying in the river, the commerce being valued at $4,532,782. The tonnage of the river is reported to be as follows: 1903, 245,568; 1904, 246,223; 1905, 67,165; 1906, 65,710; 1907, 67,024.

The improvement has made no appreciable difference in freight rates.

July 1, 1907, balance unexpended	$2,298.60
June 30, 1908, amount expended during fiscal year for maintenance of improvement	79.25
July 1, 1908, balance unexpended	2,219.35
July 1, 1908, outstanding liabilities	5.12
July 1, 1908, balance available	2,214.23
July 1, 1908, amount covered by uncompleted contracts	2,038.10
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*i*) *La Trappe River, Maryland.*—This stream, formerly known as Dividing Creek, has a length of about 3 miles and is a tributary of Choptank River. The head of navigation is at Trappe Landing. The controlling depth prior to 1893 was 4 feet, with a mean range of tide of 18 inches, but was afterwards increased to 8 feet by dredging, under private subscription. The original project, which is the existing one, was adopted by the river and harbor act of July 13, 1892, and is for a channel 150 feet wide and 11 feet deep at mean low water across the bar at the mouth and for a width of 75 feet and a depth of 8 feet inside the bar as far as Trappe Landing, with a turning basin at the latter point, at an estimated cost of $7,250, subsequently increased to $9,750. The project has been completed and the additional work required is for maintenance.

[a] See consolidated money statement on page 235.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $2,135.39 was allotted for this work. A contract was made for expenditure of funds for maintenance and dredging under it was finished the last month of 1907, restoring turning basin to project dimensions.

The amount expended to June 30, 1908, is $11,028.69, of which $3,064.82 was for maintenance.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the channel was 7 feet. Three steamers and 83 sailing vessels and barges are reported as plying in the river, the commerce being valued at $875,218.

The tonnage of the river is reported to be as follows: 1903, 11,466; 1904, 13,601; 1905, 13,848; 1906, 13,588; 1907, 13,859.

The improvement has made no appreciable difference in freight rates.

July 1, 1907, balance unexpended	$2,135.39
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,911.19
July 1, 1908, balance unexpended	224.20
July 1, 1908, amount covered by uncompleted contracts	191.29
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*j*) *Manokin River, Maryland.*—Before improvements were commenced in 1891 the depth of water at the mouth of the river at the so-called "Mud flats" was between 1 and 2 feet at low tide. These flats are about 2½ miles wide and make navigation impossible except at high water, thereby rendering the upper part of the river, which has a very fair depth and width, almost useless for extensive shipping purposes. The average rise of tide at the flats is 2.6 feet. Princess Anne is the head of navigation and is about 12 miles above the mouth of the river.

The project was adopted by the river and harbor act of September 19, 1890, and is based upon a survey made in August and September, 1889. (Report printed in Annual Report of the Chief of Engineers for 1890, p. 961.) It provides for a channel 6 feet deep at mean low water and 100 feet wide from Locust Point to Sharps Point, a distance of about 2½ miles and embracing the section called the "Mud flats," at an estimated cost of $30,000.

From 1891 to 1900 dredging on the whole project was done at various times as funds became available. At the close of these operations there was a channel 6 feet deep from Sharps Point to about a mile above Dashiells Creek and a slightly less depth to the steamboat wharf above, and at the mouth soundings taken over the area formerly dredged showed a range of depth from 4.5 to 7.3 feet. No work was done afterwards until that of the autumn of 1905, which consisted in removing shoals that had formed, and resulted in a controlling depth of but 3 feet.

[a] See consolidated money statement on page 235.

The creation and maintenance of a channel across the mud flats at the mouth of this river is a work of some difficulty and uncertainty under the method adopted, which was originally considered as tentative only and the best that the commercial importance of the project would justify. Funds have not been available for adequate maintenance and the channel has deteriorated rapidly. The estimate of cost of project was increased May 13, 1907, to $42,103.99. The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on east shore of Chesapeake Bay, and $9,160.69 was allotted for this work. A contract for expenditure of funds was made and dredging under it is in progress at close of fiscal year.

The amount expended on the improvement to June 30, 1908, is $31,055.27, and $2,000 additional was expended on the upper river, which is not included in the existing project. The amount expended for maintenance was $8,511.13. About two-thirds of the project is completed.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the channel at the mouth was 3½ feet.

It was impracticable to procure commercial statistics. The improvement has made no appreciable difference in freight rates.

It is proposed to apply the funds asked for toward completing the project.

July 1, 1907, balance unexpended	$9,160.69
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,782.77
July 1, 1908, balance unexpended	5,377.92
July 1, 1908, outstanding liabilities	12.63
July 1, 1908, balance available	5,365.29
July 1, 1908, amount covered by uncompleted contracts	4,785.33
Amount (estimated) required for completion of existing project	14,181.93
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(*k*) *Tyaskin Creek.*—This stream is also known as Wetipquin Creek, or River. It is a small tributary of Nanticoke River, having a length of about 5 miles. The controlling depth in the creek was 8 feet, but on the bar at the mouth it was but 3½ feet at mean low water, with an average rise and fall of the tide of 3 feet. A survey was made in 1899 (report printed in Annual Report of the Chief of Engineers for 1900, p. 1681). The existing project, which is the original one, was adopted by the river and harbor act of June 13, 1902, and is for a channel 9 feet deep at mean low water, with a width of 120 feet, at an estimated cost of $13,200. Under a survey made in January, 1906, the estimate of cost of completion of this project, with a suitable turning basin added, is $6,462.39.

The river and harbor act of March 2, 1907, appropriated $60,000 for improvement of rivers and harbors on the east shore of Chesapeake Bay, and $6,500 was allotted to complete the work. A contract

[a] See consolidated money statement on page 235.

was made for completion and dredging was finished, as far as funds permitted, in the spring of 1908. The channel was completed to the project depth and width, but owing to shoaling since the survey and estimate were made in January, 1906, the turning basin was left at a controlling depth of 7 feet at mean low water, which is ample for present needs. Funds asked for are intended to be applied to completing turning basin and maintenance of project.

The amount expended to June 30, 1908, is $15,748.76, of which $2,443.91 was for maintenance, and $3,146.85 on project as modified by estimate of January, 1906. The project is about two-thirds completed.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the improvement was 9 feet, and the turning basin 7 feet.

Three steamers and 36 sailing vessels and barges are reported as plying in the creek, the commerce being valued at $71,498. The tonnage of the creek is reported to be as follows: 1903, 784; 1904, 796; 1905, 856; 1906, 945; 1907, 967.

The improvement has made no appreciable difference in freight rates.

Reference to reports on examination and survey required by the river and harbor act of March 3, 1905, will be found on page 214 of the Report of the Chief of Engineers for 1906.

July 1, 1907, balance unexpended		$6,500.00
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$3,146.85	
For maintenance of improvement	2,443.91	
		5,590.76
July 1, 1908, balance unexpended		909.24
July 1, 1908, amount covered by uncompleted contracts		582.56
Amount (estimated) required for completion of existing project		2,406.30
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

CONSOLIDATED.

July 1, 1907, balance unexpended		$59,993.34
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$14,702.00	
For maintenance of improvement	18,831.66	
		33,533.66
July 1, 1908, balance unexpended		26,459.68
July 1, 1908, outstanding liabilities		25.37
July 1, 1908, balance available		26,434.31
July 1, 1908, amount covered by uncompleted contracts		22,735.60
Amount (estimated) required for completion of existing project		65,252.19
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		80,000.00

(See Appendix J 6.)

[a] See consolidated money statement on this page.

7. *Nanticoke River, Delaware and Maryland.*—This river is a tidal stream, its headwaters consisting of numerous branches rising mainly in the northern section of Sussex County, Del. The river flows in a southwesterly direction into Tangier Sound, Chesapeake Bay, and the interests for the improvement of the river center at Seaford, the head of navigation, 36 miles from the mouth, where the range of tide is about 3.4 feet.

The river and harbor act of August 18, 1894, appropriated $5,000 for improving Broad Creek River, Delaware, a branch of Nanticoke River, and provided that as much of it as might be necessary should be used for the removal of the bar extending from the railroad bridge at Seaford toward the mouth of Nanticoke River. With this appropriation the channel was dredged where necessary to a width of 100 feet and a depth of 9 feet at mean low water from the south side of the railroad bridge at Seaford to a point 8,000 feet below. A previous appropriation for the Nanticoke River in 1886 was, in accordance with the terms of the law, applied to Broad Creek River up to Laurel.

The existing project for the improvement of the Nanticoke River is based upon a survey made in 1895 (printed in Annual Report of the Chief of Engineers for 1895, pp. 1165 to 1167) and is for a channel 9 feet deep at mean low water and 100 feet wide, the width to be increased to about 150 feet at sharp turns of the channel, the improvements to be extended to within 100 feet of the county bridge, where the proposed channel is to widen out fan-shaped, at an estimated cost of $13,000. The project is completed, and the additional work required is for maintenance.

Work during the year consisted in dredging under contract, which was finished in the spring of 1908, restoring the channel dimensions below the bridge. Funds asked for are intended to be applied to maintenance.

The amount expended to June 30, 1908, was $14,697.01, of which $5,000 was on a previous project and $4,126.27 for maintenance.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the channel was 8½ feet.

Three steamers and 122 sailing vessels and barges are reported as plying in the river, the commerce being valued at $7,274,180. The tonnage of the river is reported to be as follows: 1903, 119,038; 1904, 120,229; 1905, 121,769; 1906, 119,348; 1907, 121,733.

The improvement has made no appreciable difference in freight rates.

July 1, 1907, balance unexpended	$2,000.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,697.01
July 1, 1908, balance unexpended	302.99
July 1, 1908, outstanding liabilities	12.33
July 1, 1908, balance available	290.66
July 1, 1908, amount covered by uncompleted contracts	178.60
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	2,000.00

(See Appendix J 7.)

8. Broad Creek River, Delaware.—This is a tributary of the Nanticoke River, and in 1881 the controlling depth was 1½ feet, with a mean range of tide of 3 feet. In 1889 a channel 6 feet deep at mean low water and 50 feet wide had been dredged under project dated February 4, 1880, from Bethel to Laurel, the head of navigation, about 7½ miles from the mouth of the river, at a cost of $35,000. The existing project, adopted by the river and harbor act of July 13, 1892, is for a channel 70 feet wide and 8 feet deep at mean low water between Bethel and Laurel, at an estimated cost of $15,000. The projected channel was dredged except for a short distance at the upper end, where it was reduced to 60 feet in width to secure the stability of some wharves. The work of the year was for maintenance. Contract was entered into and dredging under it finished in the spring of 1908, removing shoals above and for a distance of about 1,000 feet below the railroad bridge at Laurel. The appropriation requested is intended to be applied to maintenance.

The amount expended to June 30, 1908, is $15,100, of which $100 was for maintenance. The project is completed, and the additional work required is for maintenance.

The maximum draft that could be carried June 30, 1908, at mean low water, over the shoalest part of the channel is reported to be 7 feet.

One thousand and forty-six vessels passed through the railroad drawbridge, but this does not comprise all the shipping on the river. The tonnage of the river for 1907 is reported to be 26,353, valued at $279,149.44.

The improvement is reported to have made a reduction of 25 per cent in freight rates.

July 1, 1907, balance unexpended	$1,500.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	100.00
July 1, 1908, balance unexpended	1,400.00
July 1, 1908, amount covered by uncompleted contracts	1,354.75
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix J 8.)

9. Wicomico River, Maryland.—The portion of the river at and just below Salisbury, which is the head of navigation and 23 miles from the mouth, has been under improvement by the United States since 1872, under project dated April 15, 1871. The average rise and fall of tide is 3 feet. At that time the navigable channel, with a minimum depth of 8 feet at low water, extended to a point within 2 miles of Salisbury. The extreme upper portion, as far as the milldam in the heart of the town, was quite shoal, and has an average depth of only 18 inches at low tide. Between 1872 and 1885 a channel 75 to nearly 100 feet wide and 7 feet deep at low water was dredged from deep water below to the drawbridge in the town, at a cost to the Government of about $50,000.

The existing project, based upon a survey of the river made in 1889 (printed in Annual Report of the Chief of Engineers for 1890, pp. 947–950), provides for a channel 9 feet deep at mean low water, from that depth below to the drawbridge at Salisbury, the width to be from 100 to 150 feet, at an estimated cost of $23,200. At the time this project was adopted there existed a 7-foot low-water channel from 75 to 100 feet wide to Salisbury. The project has been completed, and the additional work required is for maintenance.

Work during the year was for maintenance. Contract was entered into and dredging under it finished in the spring of 1908, restoring dimensions of the upper part of the channel.

The amount expended to June 30, 1908, is $87,253.42, of which $50,000 was on previous projects and $7,197.66 for maintenance.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the channel under improvement was 8 feet.

Two steamers and 82 sailing vessels and barges are reported as plying in the river, the commerce being valued at $14,044,966. The tonnage of the river is reported to be as follows: 1903, 197,306; 1904, 199,279; 1905, 202,510; 1906, 198,451; 1907, 202,416. The improvement has made no appreciable difference in freight rates.

Reference to reports on examination and survey of the river required by the river and harbor act of March 3, 1905, will be found on page 215 of the Report of the Chief of Engineers for 1906.

It is proposed to apply the appropriation asked for in restoring channel to project dimensions below Williams wharf.

July 1, 1907, balance unexpended	$2,500.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,255.42
July 1, 1908, balance unexpended	244.58
July 1, 1908, amount covered by uncompleted contracts	224.76
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix J 9.)

10. Crisfield Harbor, Maryland.—This harbor is situated at Somers Cove, Little Annemessex River, which at this point is an estuary of Tangier Sound, on the east side of Chesapeake Bay. It is the principal port of the collection district of eastern Maryland. Crisfield is the head of navigation of the harbor and is 1 mile from its mouth. The length of the navigable portion of the harbor is 1¼ miles. Originally the harbor had a controlling depth of 8½ feet at mean low water for a width of 400 feet, with a mean rise and fall of tide of 2.6 feet, but this was not deemed adequate for the commerce of the port. The original project adopted by the river and harbor act of March 3, 1875, was for a channel 266 feet wide and 12 feet deep at mean low water from above the railroad wharf to a point known as the second angle, opposite Somers Cove light, and from that point to deep water below, a channel of the same depth 425 feet wide, and in addition a basin on both the north and south sides of the railroad wharf 12 feet deep,

at an estimated cost of $37,317.50. The work was completed May, 1876. No dredging has been done since, and the work has been without maintenance for about thirty years.

The act of March 3, 1905, authorized a survey, which was made in December, 1905, the report thereon being printed in House Document No. 783, Fifty-ninth Congress, first session. The existing project, adopted by the river and harbor act of March 2, 1907, is to restore the channel formerly dredged and to restore and widen the anchorage basin, at an estimated cost of $37,706.62, and an annual cost for maintenance of $800. The river and harbor act of March 2, 1907, made an appropriation of $37,707 for the completion of this project.

There were no operations during the year, but a contract has been entered into for completion of the work. To June 30, 1908, $46.43 has been expended on existing project.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the channel under improvement was 8 feet.

Eight steamers and 357 sailing vessels and barges are reported as plying in the harbor, the commerce being valued at $2,197,350. The tonnage of the harbor is reported to be as follows: 1906, 30,265; 1907, 30,738.

A report on a survey of this harbor is to be found beginning on page 105, Part 2, Annual Report of the Chief of Engineers for 1875.

July 1, 1907, balance unexpended	$37,707.00
June 30, 1908, amount expended during fiscal year for works of improvement	46.43
July 1, 1908, balance unexpended	37,660.57
July 1, 1908, outstanding liabilities	20.00
July 1, 1908, balance available	37,640.57
July 1, 1908, amount covered by uncompleted contracts	33,936.30

(See Appendix J 10.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—During the past fiscal year the following wrecks were removed: Schooner *Samuel D. Lankford*, from Chesapeake Bay, near Swan Point, Maryland, at a cost of $321, and the sloop *Potter*, from Baltimore Harbor, Maryland, at a cost of $90. The total amount expended was $411.

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination with plan and estimate of cost of improvement of Lower Thoroughfare, at or near Wenona, Deal Island, Maryland.—Reports dated April 18 and May 21, 1907, respectively, are printed in House Document No. 76, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $5,300 is presented.

2. Preliminary examination and survey of Northwest Fork of Nanticoke River (Marshyhope Creek), from its mouth to Federalsburg, Md.—Reports dated May 1, 1907, and January 7, 1908, respectively, are printed in House Document No. 869, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $44,200 is presented.

The local officer was also charged with the duty of making a preliminary examination and survey of *Tuckahoe River, Maryland, from Wayman's wharf to the town of Hillsboro*, provided for in the river and harbor act of March 2, 1907, and reports thereon will be duly submitted.

IMPROVEMENT OF RIVERS AND HARBORS IN THE WASHINGTON, DISTRICT OF COLUMBIA, DISTRICT.

This district was in the charge of Maj. Spencer Cosby, Corps of Engineers, to April 30, 1908, having under his immediate orders First Lieut. Elliott J. Dent, Corps of Engineers, and in the temporary charge of Lieutenant Dent since that date. Division engineer, Col. D. W. Lockwood, Corps of Engineers.

1. Potomac River at Washington, D. C.—Before improvement the Virginia channel was obstructed by two bars. The upper bar extended upstream from Long Bridge to about one-half mile below Easby Point, and the ruling depth on this bar was 8 feet. The lower bar was near Giesboro Point and had a ruling depth of 14 feet. The ruling depth in the Washington channel was 10 feet. Georgetown Harbor was obstructed by several dangerous rocks. The flats, which extended to the edge of the Virginia channel, were largely bare at low water and were an active agent in spreading malarial and other diseases.

Between June 11, 1870, and March 3, 1881, the sum of $290,000 was appropriated by Congress for the improvement of the harbors of Washington and Georgetown. The project under which this sum was expended is not definitely stated, although it is understood that it provided for dredging channels 16 feet deep and 200 feet wide through the Georgetown and Washington channels, and for the removal of the most dangerous rocks obstructing navigation in the harbor of Georgetown to a depth of 20 feet.

The existing project for the improvement was adopted August 2, 1882, and has for its object the improvement of the navigation of the river by widening and deepening its channels, the reclamation of the flats by depositing on them the material dredged from the channels, the freeing of the Washington channel of sewage, and the establishment of harbor lines. To effect these, the project provided "that the channel depths * * * should be sufficient to accommodate the largest draft vessels that can be brought up to Arsenal Point" (the projected depth was not stated in feet, but by the above-imposed condition was at that time limited to 20 feet at low tide, whereas the ruling depth in the Potomac River below Washington has now been increased by dredging to 24 feet at low tide), that the flats be reclaimed to a height of 3 feet above the flood plane of 1877 (which, although the highest recorded freshet at that time, was exceeded by about 3 feet by the flood of 1889), and for a tidal reservoir to be pro-

vided with automatic inlet and outlet gates. A training dike on the Virginia shore extending downstream from Analostan Island was added to the project in 1890. The project also provided for the rebuilding of Long Bridge and for the interception of all sewage discharged into the Washington channel, but neither of these works was included in the estimated cost of the improvement, which was $2,716,365. The estimate as revised in 1897 is $2,953,020.

The amount expended on the work of the existing project to June 30, 1908, was $2,599,118.54, of which $383,500.44 has been applied to maintenance since March 3, 1899. The following sums have been obtained from other sources than appropriations: Received from sale of blueprints, 50 cents; of condemned property, $89.03; total, $89.53.

The expenditure resulted in the dredging of a channel 20 feet deep and 550 feet wide through the bar above Long Bridge, in increasing the width of the natural channel just below Long Bridge by 50 to 500 feet, and in deepening it to 20 feet; in dredging a channel 350 feet wide and 20 feet deep through the bar in the Virginia channel near Giesboro Point; in dredging the Washington channel to a width of 400 feet and a depth of 20 feet; in dredging between this navigation channel and the wall of the adjacent reclaimed area to a depth of 12 feet; in dredging at the junction of the Washington and Virginia channels; in dredging the tidal reservoir (111 acres) to a depth of about 8 feet, and restoring this depth to 75 per cent of its area; in several times redredging cuts 20 feet deep through bars which had reformed by freshet action in the Virginia and Washington channels; in the completion of and repairs to the reservoir outlet; in the construction of about 12 per cent of the combined inlet gates and bridge for the tidal reservoir; in the construction of 35,289 linear feet of sea wall, of which 7,106 linear feet has been taken down and relaid; and in the building of 5,965 linear feet of training dike, containing about 21,218 cubic yards of stone.

The area of land reclaimed by these operations is 628 acres (or, including reservoir, 739 acres), which, by act of March 3, 1897, was declared to be a public park, under the name of "Potomac Park."

The total amount of material deposited on Potomac Park is about 14,064,616 cubic yards, of which 13,464,616 cubic yards was dredged by the Government in prosecuting the improvements, and about 600,000 cubic yards was placed by private parties working under permits.

The entire project is now about three-fourths completed.

The work of maintenance during the year consisted in partly redredging the Virginia channel and tidal reservoir; in repairing wing walls, fender piles, and tidal gates at the reservoir outlet; in making additions and repairs to sea wall; in removing the old Long Bridge; in care of property and in repairs to plant, etc., and in general maintenance of the improvement.

The work on the project during the year consisted in commencing the building of the combined inlet gates and bridge for the reservoir.

The project for the improvement of the Potomac River at Washington provides for a flushing basin, with automatic gates at the inlet and outlet, so arranged that at each oscillation of the tide the basin or tidal reservoir will be filled during flood tide from the Virginia

channel, and emptied to the level of low water during the ebb tide into the Washington channel.

In order to provide for a highway connecting the park drives on each side of the inlet to the tidal reservoir, an appropriation of $25,000 was made by act of Congress approved May 27, 1908 (sundry civil appropriation act), to defray the additional expense involved in widening the proposed inlet gates and constructing a road across them.

The plans provide for a structure with automatic gates to close during the ebb and open during the flood tide, with curtain gates to be closed when the Potomac River is heavily charged with sediment, with a lock for the passage of small water craft, and with a park highway over the top. The structure will rest upon a pile foundation and will be of concrete or reenforced concrete throughout. A consulting architect has been employed to design the ornamental features.

Preliminary surveys and current observations have been made, general plans have been prepared and approved by the Chief of Engineers, detail plans are in course of preparation, nearly all of the necessary construction plant has been repaired and erected, and proposals for furnishing materials for the concrete by contract were opened during the latter part of June. Practically the entire foundation has been dredged and about one-third of the bearing piles have been driven.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the Washington channel was 21 feet; for the Virginia channel it was 16½ feet. The mean range of tide is about 3 feet.

The Potomac River is navigable to the foot of Little Falls, 3½ miles above Georgetown, but the Aqueduct Bridge, which crosses the river at Georgetown, 113 miles above the mouth of the river, has no draw and limits the navigation of large steamers and masted vessels.

The principal articles of commerce are sand and gravel, coal, lumber, ice, cord wood, stone, oils, oysters, bricks, coke, and general merchandise. The receipts and shipments during 1907 amounted to about 798,989 tons and were estimated to be worth about $7,596,494.

The benefits to navigation from the improvements made have been marked. Vessels of much deeper draft than those formerly used are now engaged in this trade, and it is understood that freight rates have been materially reduced.

It is proposed to apply the funds on hand and the additional appropriation recommended toward construction of the tidal gates, construction of additional sea wall, reconstruction of about 10,000 linear feet of damaged sea wall, dredging in the Washington channel, and prosecution of the project.

The additional work proposed is for the purpose of extension of benefits and for the maintenance of the improvement in a serviceable condition.

Maps of the locality may be found in each Annual Report of the Chief of Engineers since 1877, with the exception of those for 1879, 1882, 1893, 1905, and 1906.

Reference to the report on the examination and survey of Potomac River at Washington, D. C., will be found on page 194 of the Annual Report of the Chief of Engineers for 1904.

IMPROVING POTOMAC RIVER.

July 1, 1907, balance unexpended		$260,235.91
Amount received from sale of condemned property		89.03
		260,324.94
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$13,787.86	
For maintenance of improvement	53,566.09	
		67,353.95
July 1, 1908, balance unexpended		192,970.99
July 1, 1908, outstanding liabilities		2,173.28
July 1, 1908, balance available		190,797.71
July 1, 1908, amount covered by uncompleted contracts		69,631.43
Amount (estimated) required for completion of existing project		544,520.44
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		125,000.00

TIDAL GATES, POTOMAC PARK.

Amount appropriated by sundry civil act approved May 27, 1908	$25,000.00
July 1, 1908, balance unexpended	25,000.00
July 1, 1908, amount covered by uncompleted contracts	4,100.00

(See Appendix K 1.)

2. Potomac River below Washington, D. C.—The Potomac River below Washington, D. C., is generally a wide and deep body of water, having the characteristics of a tidal estuary rather than of a fluvial stream.

Prior to improvement 24-foot navigation was obstructed by seven shoals, over which the depth ranged from 19½ to 23 feet at low tide. Several of these shoals were long and formed serious obstructions to navigation by deep-draft vessels.

The present, which is also the original, project for this improvement was adopted March 3, 1899. It provides for the improvement of the waterway by dredging channels 24 feet deep and 200 feet wide through all obstructions to 24-foot navigation below Washington, D. C., at an estimated cost of $176,000.

The amount expended to June 30, 1908, was $185,000, of which about $31,164 was applied to maintenance.

As a result of this expenditure, channels 24 feet deep and at least 200 feet wide have been dredged through all the shoals, and 1,484,362 cubic yards of material has been excavated.

The work during the year consisted in a preliminary examination and survey, with a view to obtaining a width of channel of 400 feet, made in compliance with the requirements of the river and harbor act of March 2, 1907. The report and estimates were printed in House Document No. 859, Sixtieth Congress, first session.

The maximum draft that could be carried on June 30, 1908, at mean low water over the shoalest part of the locality under improvement was 24 feet. The mean range of tide varies from about 1.6 feet

at the lower shoals to about 2.8 feet at the upper. Georgetown, 113 miles above the mouth of Potomac River, is the head of navigation for large vessels.

The principal articles of commerce are sand and gravel, coal, lumber, ice, oils, naval ordnance and supplies, cord wood, brick clay, stone, fertilizer, oysters, bricks, phosphate rock, coke, paving blocks, railroad ties, asphalt, potash salt, and general merchandise. The receipts and shipments during 1907 amounted to about 1,442,900 tons, and were estimated to be worth about $21,093,800.

As far as known the work done has had no material effect upon freight rates.

The work provided for under the present project has been completed, and no further appropriation is required therefor.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1890, 1900, 1902, and 1903.

For reference to the reports of the examinations and surveys of Potomac River below Washington, D. C., see page 197 of the Annual Report of the Chief of Engineers for 1904, and House Document No. 859, Sixtieth Congress, first session.

July 1, 1907, balance unexpended	$1,164.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	164.00
July 1, 1908, balance unexpended	1,000.00

(See Appendix K 2.)

3. Anacostia River, District of Columbia.—Before improvement the ruling depth from the mouth to the Navy-Yard Bridge was about 18 feet, the channel affording this depth being narrow and tortuous.

An allotment of $20,000 for work in the Anacostia was made from the appropriation of September 19, 1890, for improving Potomac River at Washington. Under this allotment channels 20 feet deep and about 200 feet wide were dredged through shoals near the foot of South Capitol street and opposite Washington Barracks. This dredging was completed in May, 1892, at a cost of $18,536.94, and the balance, $1,463.06, was applied to the present project.

The present project for this stream was adopted June 13, 1902, and provides for the improvement of the portion of Anacostia River below the Navy-Yard Bridge by dredging a channel 20 feet deep for a width of 400 feet, the depth then gradually decreasing to 6 feet at the bulkhead lines, and by depositing the dredged material on the adjacent flats to an average elevation of 7 feet above low tide, the reclaimed area to be surrounded by an earthen embankment to a height of 14 feet above low tide, protected by a masonry sea wall, and provided with suitable drainage through the embankment, all at an estimated cost of $1,218,525.

The amount expended on the existing project to June 30, 1908, was $180,504.68, none of which was applied to maintenance. As a result of this expenditure, a channel 20 feet deep at mean low water and at least 300 feet wide (except at Buzzard Point, where the width is about 240 feet) has been secured for a distance of 9,130 feet upstream from the mouth of the Anacostia, i. e., up to the center of the navy-yard. The quantity excavated to date amounts to 1,138,454 cubic yards, in addition to which 170,000 cubic yards has been dredged by other departments of the Government and by private parties under permits from, but without cost to, this office.

A riprap wall has been built to a height of 4 feet above mean low water for a distance of 4,900 feet along the left bulkhead line. This wall contains 23,344 cubic yards of stone, 12,174 cubic yards of which was placed during the fiscal year 1908. It will temporarily serve to retain dredged material and will ultimately form the foundation for the projected masonry sea wall.

Seven hundred and ninety-one piles of the old dismantled wharf opposite the navy-yard have been removed.

Incidental to the improvement of the channel about 110 acres of flats have been filled by the deposit of excavated material to an average height of 4 feet above low tide. Harbor lines have been established from the mouth of the river up to Pennsylvania Avenue Bridge.

The entire project is now about 14 per cent completed.

The maximum draft that could be carried on June 30, 1908, over the shoalest part of the locality under improvement was 18½ feet. The mean range of tide is about 3 feet.

Anacostia River is navigable for large vessels to the Navy-Yard Bridge, for tugs and small vessels to Pennsylvania Avenue Bridge, and for small scows and lighters to Bladensburg, Md., respectively, 2, 2¾, and 8¾ miles above its mouth.

The principal articles of commerce are sand and gravel, naval ordnance and supplies, brick clay, stone, coal, oils, paving blocks, and cord wood. The receipts and shipments during 1907 amounted to about 287,975 tons, and were estimated to be worth about $4,312,687.

The improvement already made has been of benefit to navigation and has resulted in the diversion of considerable traffic from the Washington channel, where conditions were rapidly becoming congested. It is not known that any reduction in freight rates has resulted from the work done.

It is proposed to apply the additional appropriation recommended toward dredging, reclaiming the flats, and completion of the project.

The additional work proposed is for the extension of benefits.

Maps of the locality will be found in the Annual Reports of the Chief of Engineers for 1903, 1904, 1905, and 1906.

Reference to reports upon examinations and surveys of this river will be found on page 198 of the Annual Report of the Chief of Engineers for 1904.

A report relative to the title to Anacostia flats is printed in House Document No. 194, Fifty-ninth Congress, first session.

July 1, 1907, balance unexpended	$125,122.65
June 30, 1908, amount expended during fiscal year, for works of improvement	27,161.27
July 1, 1908, balance unexpended	97,958.38
July 1, 1908, outstanding liabilities	1,736.93
July 1, 1908, balance available	96,221.45
July 1, 1908, amount covered by uncompleted contracts	85,859.35
Amount (estimated) required for completion of existing project	940,061.94
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	150,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix K 3.)

4. Breton Bay, Maryland.—Breton Bay, a tidal estuary of the Potomac River, is about 6½ miles long and well landlocked. Fifteen feet of water can be carried up the bay for a distance of 4 miles. At the time of the adoption of the project for its improvement, 10-foot navigation in Breton Bay was obstructed by a shoal commencing 5 miles above the mouth and extending to Leonardtown, at the head of the bay. The least channel depth over this shoal was 5 feet at low tide.

The original project for improvement, adopted in 1878 and modified in 1886 and 1890, provided for dredging a channel 150 feet wide and 9 feet deep from the 9-foot contour in Breton Bay to the Leonardtown wharf, with a turning basin for steamboats at the wharf 400 feet wide and 600 feet long, at an estimated cost of $30,000.

From June 18, 1878, to September 19, 1890, nine appropriations, aggregating $37,500, were made. This sum was applied to dredging 214,229 cubic yards of material. The work called for by the original project was completed in 1891.

The present project for this improvement was adopted June 13, 1902, and contemplates the dredging of a channel and turning basin 10 feet deep, the channel to have a minimum width of 200 feet and the turning basin to be 400 feet wide and 600 feet long. The estimated cost of the project is $36,480.

The Board of Engineers for Rivers and Harbors considered this project and recommended, in report dated September 22, 1903, that $6,000 be expended at the earliest practicable date in providing a channel 10 feet deep and wide enough to accommodate the boats now trading in this stream, including a turning basin of ample dimensions at Leonardtown wharf, $4,000 to be applied to new work and $2,000 to maintenance.

It was the opinion of the Board that the expenditure of $4,000 every four years thereafter would be enough to maintain a sufficient turning basin and a channel at least 100 feet wide and wider at the turn, all of a 10-foot depth.

The amount expended under the present project to June 30, 1908, was $11,437.90, of which about $1,500 was applied to maintenance. As a result of this expenditure there has been dredged a channel from Leonardtown wharf to deep water in Breton Bay 150 feet wide, 10 feet deep, and 6,100 feet long, with a turning basin at its head of the same depth, 275 feet wide, and about 500 feet long. The width of the channel is increased to about 220 feet at the turn at Buzzard Point. The project as recommended by the Board of Engineers for Rivers and Harbors is completed, except for maintenance.

The total amount of material dredged from the channel under the present project is about 57,000 cubic yards. No work of maintenance was done during the fiscal year ending June 30, 1908.

The maximum draft that could be carried on June 30, 1908, at mean low water, over the shoalest part of the locality under improvement was 10 feet. The mean range of tides is about 1.7 feet. Leonardtown, 6 miles above the mouth of the bay, is the head of navigation.

The principal articles of commerce are oysters, railroad ties, cord wood, lumber, grain, tobacco, farm produce, coal, and general merchandise. The receipts and shipments during 1907 amounted to about 6,744 tons and were estimated to be worth about $178,668. The number of passengers carried is about 2,000 a year.

The improvement has been of great benefit to shippers in this vicinity, but as far as known there has been no material reduction in freight rates.

In conformity with the recommendation of the Board of Engineers for Rivers and Harbors the appropriation requested is to be applied to maintenance of the channel and turning basin.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887 and 1889.

For reference to reports on examinations and surveys of this locality, see page 199 of the Annual Report of the Chief of Engineers for 1904. For report of Board of Engineers for Rivers and Harbors referred to above, see Annual Report of the Chief of Engineers for 1908, page 1045.

July 1, 1907, balance unexpended	$1,090.72
June 30, 1908, amount expended during fiscal year for works of improvement	528.62
July 1, 1908, balance unexpended	562.10
July 1, 1908, amount covered by uncompleted contracts	485.65
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	4,000.00

(See Appendix K 4.)

5. *York, Mattaponi, and Pamunkey rivers, and Occoquan and Carters creeks, Virginia.*—(*a*) *York River.*—Prior to improvement 24 feet could be carried up York River for a distance of 32 miles, to Potopotank bar, over which the ruling depth was 18½ feet. West Point bar, the only other obstruction to navigation, had a least depth of 15½ feet.

The project for this improvement, adopted June 14, 1880, and revised in 1884 and 1887, provides for dredging channels 22 feet deep at mean low water and 400 feet wide through the bars, and for the construction of a dike along the right bank at West Point bar to maintain the channel, at a total estimated cost of $308,800.

The amount expended to June 30, 1908, was $250,065.27, of which $22,142.04 was applied to maintenance subsequent to March 3, 1899. This expenditure has resulted in a dredged channel 105 feet wide and 22 feet deep at Potopotank, and another 22 feet deep and 160 to 260 feet wide at West Point bar. A training dike 10,142 feet long has been constructed at West Point bar and 5,100 linear feet of it has been rebuilt or repaired. The total amount of material dredged from the channels is about 1,160,100 cubic yards.

The entire project is now about 60 per cent completed.

The work of maintenance during the fiscal year consisted in work incident to the repair of the dike.

The maximum draft that could be carried on June 30, 1908, at mean low tide over the shoalest part of the locality under improvement was about 20 feet. The mean range of tides is about 3 feet. York River is navigable throughout its entire length of 41 miles to West Point at its head.

The principal articles of commerce are lumber, oysters, cord wood, tobacco, railroad ties, farm produce, ship timber, piles, and general merchandise. The receipts and shipments during 1907 amounted to about 142,189 tons, and were estimated to be worth about $5,263,397.

The work done has been of much importance to commerce, and it is understood that freight rates have been somewhat reduced.

It is proposed to apply the additional appropriation recommended to the repair of the dike.

The additional work proposed is designed for the preservation of work already done.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1886, 1887, and 1894.

For reference to report on examination and survey of York River see page 201 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1907, balance unexpended	$7,058.44
June 30, 1908, amount expended during fiscal year for maintenance of improvement	251.85
July 1, 1908, balance unexpended	6,806.59
July 1, 1908, outstanding liabilities	55.25
July 1, 1908, balance available	6,751.34
Amount (estimated) required for completion of existing project	74,070.18
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *Mattaponi River.*—The Mattaponi River is navigable for small steamers and vessels from its mouth to Aylett, about 39 miles above, and can be made navigable for small barges from Aylett to Monday bridge, 16 miles farther. At the time of the adoption of the project the obstructions to 5½-foot navigation below Aylett consisted of seven bars, upon which the ruling depths at low tide varied from 2.4 to 3.8 feet. Above Aylett there were numerous bars, but no work upon them has been proposed. The river was also obstructed by snags, wrecks, and overhanging trees.

The original project for improvement, adopted June 14, 1880, provided for the removal of snags, wrecks, and leaning trees below Monday bridge, and the improvement of the bars below Aylett, so as to give a depth of 5½ feet at low tide and a channel width of 40 feet, at an estimated cost of $34,059. This project was extended by the terms of the river and harbor act of July 13, 1892, which provided for the removal of snags as far up as Guineas bridge, near Milford station, on the Richmond, Fredericksburg and Potomac Railroad. The estimated cost of this, which is the present project, is $72,100.

The amount expended to June 30, 1908, was $32,011.84, of which $2,252.92 has been applied to maintenance since March 3, 1899. This expenditure resulted in the removal of snags, logs, and overhanging trees from the river between Robinson bar, 34 miles above the mouth, and Monday bridge, and in keeping the river below Aylett free from such obstructions; in constructing 2,297 linear feet of dike at Robin-

[a] See consolidated money statement on page 253.

son bar, and in dredging channels of the full projected dimensions entirely through Line Tree and partly through Latané and Walker bars. The total amount of material dredged from the channels is about 15,710 cubic yards. The entire project is now about 35 per cent completed.

The work of maintenance during the fiscal year consisted in work incidental to redredging a portion of the channel at Latané bar.

The maximum draft that could be carried at mean low water over the shoalest part of the channel June 30, 1908, was 3 feet at Latané bar. The mean range of tide is about 3 feet. Aylett, 39 miles above the mouth of the river, is the present head of navigation.

The principal articles of commerce are lumber, cord wood, farm produce, railroad ties, piles, ship timber, and general merchandise. The receipts and shipments during 1907 amounted to about 87,260 tons, and were estimated to be worth about $925,416.

The work done has been of considerable benefit to commerce, and it is understood that not only have shipments been facilitated, but that freight rates have been somewhat reduced.

It is proposed to apply the additional appropriation recommended to dredging and dike construction at Line Tree and Latané bars, and to snagging.

The additional work proposed is partly necessary to make the improvement available, partly for the extension of benefits and partly for the preservation of work already done.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887, 1888, and 1890.

For reference to reports on examinations and surveys of this locality, see page 212 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1907, balance unexpended		$10,955.69
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$309.09	
For maintenance of improvement	58.44	
		367.53
July 1, 1908, balance unexpended		10,588.16
July 1, 1908, outstanding liabilities		252.44
July 1, 1908, balance available		10,335.72
July 1, 1908, amount covered by uncompleted contracts		5,910.79
Amount (estimated) required for completion of existing project		31,752.92
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(*)

(c) *Pamunkey River.*—At the time of the adoption of the project for the improvement of Pamunkey River, a draft of 7 feet could be carried at low tide to Buckland bar, 35½ miles above its mouth. Between this bar and Bassett Ferry, a distance of 5½ miles, there were four bars, the ruling depths on which varied from 2½ to 5½ feet.

* See consolidated money statement on page 22.

Besides these bars the river was obstructed by wrecks, logs, snags, and overhanging trees.

The original, which is also the existing, project for the improvement of this river was adopted June 14, 1880, and amended in 1885 and 1908. It contemplates securing a channel 7 feet deep and 100 feet wide between Bassett Ferry and the mouth of the river, this result to be obtained by dredging and the construction of dikes, the latter being also designed to secure the dredged material deposited behind them. The wrecks, snags, logs, and trees obstructing navigation are also to be removed. The estimated cost of the revised project is $55,000. It is estimated that an expenditure of $3,200 is now required for maintenance, in addition to the work which can be done with available funds, and that in future the cost of maintenance will be $4,000 every 4 years.

The amount expended to June 30, 1908, was $27,306.66, of which $2,872.05 was applied to maintenance after March 3, 1899. This expenditure has resulted in dredging channels 100 feet wide and 7 feet deep through Buckland bar, and 95 feet wide and 6 to 7 feet deep through Skidmore bar, in the construction of 1,478 linear feet of sheet pile dikes at Spring and Skidmore bars, in removing parts of seven wrecks, and in removing snags and similar obstructions from about 30 miles of river and keeping it free from such obstructions. The total amount of material dredged from the channels is about 15,600 cubic yards.

The entire project is now about 50 per cent completed.

No work of maintenance was done during the fiscal year ended June 30, 1908.

The maximum draft that could be carried on June 30, 1908, at mean low tide over the shoalest part of the locality under improvement was 5.3 feet. The mean range of tide varies from 2 to 3 feet. Bassett Ferry, 47 miles above the mouth of the river, is the head of navigation for vessels drawing 5 feet.

The principal articles of commerce are lumber, cord wood, railroad ties, ship timber, salt, and grain. The receipts and shipments during 1907 amounted to about 41,533 tons and were estimated to be worth about $304,426.

The work done has been of benefit to commerce, and it is understood that not only have shipments been facilitated, but freight rates have been reduced.

It is proposed to apply the additional appropriation recommended to the removal of the remaining wrecks, the removal of snags, logs, and overhanging trees, the redredging of the channel at Buckland bar, and to dredging and dike construction at Hogan bar.

The additional work proposed is necessary to make the improvement available, and for maintenance and preservation of the work already done.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887, 1888, and 1890.

For reference to the report on an examination and survey of Pamunkey River, see page 213 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1907, balance unexpended	$8,324.13
June 30, 1908, amount expended during fiscal year for works of improvement	230.79
July 1, 1908, balance unexpended	8,093.34
July 1, 1908, amount covered by uncompleted contracts	2,340.00
Amount (estimated) required for completion of existing project	22,472.05
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, and for maintenance, in addition to the balance unexpended July 1, 1908	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*d*) *Occoquan Creek.*—In 1872 navigation in Occoquan Creek, a tributary of the Potomac River, was obstructed by three bars, over which but 1.2 feet could be carried at low tide. Aside from these obstructions the creek was amply wide and deep at low tide for vessels drawing up to 5 feet.

The original project for improvement, adopted March 3, 1873, and modified in 1879 provided for dredging channels 100 feet wide and 5 feet deep through the bars below the town of Occoquan, and the construction of a dike at Sand bar, at an estimated cost of $25,000. Four appropriations were made from 1873 to 1878, aggregating $25,000, and in 1880 the improvement was regarded as completed.

The existing project for this stream, adopted September 19, 1890, and extended by act of March 2, 1907, contemplates the dredging of channels 6 feet deep through the five bars obstructing 6-foot navigation below the town of Occoquan. These channels are to be 100 feet wide, except through the outer bar and the lower 2,000 feet of the bar next above it, where the channel is to be 150 feet wide. Dikes are to be constructed at the upper three bars. The estimated cost of the project as modified is $64,000.

The amount expended under the existing project to June 30, 1908, was $49,111.17, of which $14,312.60 was applied to maintenance subsequent to March 3, 1899. As a result of this expenditure, channels of the full projected dimensions have been dredged through all of the bars and redredged where shoaling occurred, and 1,696 linear feet of dike has been constructed at Occoquan bar and Sand bar and repaired where injured by freshets and ice.

The total amount of material dredged from the channels is about 341,145 cubic yards. There has been placed in the dikes about 6,475 cubic yards of stone.

The entire project is now about 60 per cent completed.

The work of maintenance during the year consisted in redredging the channel at Upper Mud bar, partly redredging the channel at Lower Mud bar, and repairing the dikes at Occoquan and Sand bars.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the locality under improvement was 6.5 feet. The mean range of tide is about 2 feet. The town of Occoquan, 6 miles above the mouth, is the head of navigation.

The principal articles of commerce are railroad ties, building sand, piles, cord wood, lumber, grain, farm produce, coal, and flour. The

[a] See consolidated money statement on page 253.

receipts and shipments during 1907 amounted to about 26,888 tons, and were estimated to be worth $66,647.

The work done has been of great benefit to navigation in this creek, and it is understood that not only have shipments been facilitated, but freight rates have been materially reduced.

It is proposed to apply the additional appropriations recommended to construction of dikes and maintaining the channels of the project.

The additional work proposed is for the purpose of extension of benefits and maintenance of the work already done.

For reference to reports on examinations and surveys of this locality see pages 202 and 203 of the Annual Report of the Chief of Engineers for 1904 and page 237 of the Annual Report of the Chief of Engineers for 1906.

July 1, 1907, balance unexpended		$25,887.58
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$11,201.42	
For maintenance of improvement	10,497.92	
		21,699.34
July 1, 1908, balance unexpended		4,188.24
July 1, 1908, outstanding liabilities		41.33
July 1, 1908, balance available		4,146.91
July 1, 1908, amount covered by uncompleted contracts		1,746.51
Amount (estimated) required for completion of existing project		25,013.19
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

(*e*) *Carters Creek.*—Before improvement the entrance to Carters Creek, a tidal estuary of the Rappahannock River, was obstructed by a bar over which but 10½ feet could be carried at low tide, and navigation was rendered difficult near Gallyhook Point within the creek by the projection of this point into the channel, which was about 12 feet deep at low tide.

The original, which is also the existing, project for this improvement was adopted June 13, 1902, and provides for dredging a channel at the mouth to afford a navigable depth at low tide of 15 feet, with a width of 200 feet, including necessary widening at Crab Point, for the construction of a jetty for the protection of this channel, and for the dredging of a channel 12 feet deep and 100 feet wide at Gallyhook Point, at a total estimated cost of $35,700.

The amount expended to June 30, 1908, was $28,062.33, none of which was applied to maintenance. As a result of this expenditure a channel 200 feet wide and 15 feet deep has been dredged through the bar at the mouth of the creek. The bar at the end of Crab Point has been dredged to a depth of 15 feet within the channel limits. A channel 100 feet wide and 12 feet deep has been excavated at Gallyhook Point. A stone jetty 742 feet long has been constructed at the mouth of the creek. Harbor lines have been established. The total amount of material dredged from the channels is 65,893 cubic yards. There has been placed in the jetty 1,507 cubic yards of stone. The entire project is now completed.

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[a] See consolidated money statement on page 253.

The maximum draft that could be carried on June 30, 1908, at mean low tide over the shoalest part of the outer bar was 15 feet, and at Gallyhook Point was 12 feet. The mean range of tide is 1.5 feet. Irvington, about 1½ miles above the mouth of the creek, is the head of navigation for large steamers, while small sailing vessels drawing up to 5 feet can ascend about 1 mile farther.

The principal articles of commerce are fish, oysters, lumber, coal, guano, fish oil, wood, bricks, ice, farm produce, canned goods, and general merchandise. The receipts and shipments during 1907 amounted to about 45,573 tons and were estimated to be worth $841,043. There is a good passenger trade in Carters Creek, which is also an important harbor of refuge.

The work done has been of considerable benefit to commerce, but as far as known has had no effect upon freight rates.

The work contemplated in the project being completed, no further appropriation is asked for at present. It is anticipated that an appropriation of about $5,000 every eight years will be required for maintenance.

For reference to the report upon an examination and survey of Carters Creek, see page 206 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1907, balance unexpended		$10,393.23
June 30, 1908, amount expended during fiscal year for works of improvement		8,867.08
July 1, 1908, balance unexpended		1,526.15
July 1, 1908, outstanding liabilities		46.92
July 1, 1908, balance available		1,479.23
July 1, 1908, amount covered by uncompleted contracts		335.22

CONSOLIDATED.

July 1, 1907, balance unexpended		$62,619.07
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$20,608.38	
For maintenance of improvement	10,808.21	
		31,416.59
July 1, 1908, balance unexpended		31,202.48
July 1, 1908, outstanding liabilities		395.94
July 1, 1908, balance available		30,806.54
July 1, 1908, amount covered by uncompleted contracts		10,332.52
Amount (estimated) required for completion of existing project		153,308.34
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		66,400.00

(See Appendix K 5.)

6. Nomini Creek, Virginia.—Before improvement the navigation of Nomini Creek, a tributary of the Potomac, was obstructed by a bar at its mouth over which but 3 feet could be carried at low tide. Except for this bar a draft of 8 feet could be carried to Nomini Ferry, 4 miles above the mouth, and 5 feet could be carried 2 miles farther to the head of navigation.

The project for this improvement, adopted March 3, 1873, and modified in 1879, 1885, 1888, 1890, 1897, and 1908, provides for a channel through the bar 150 feet wide and 9 feet deep, with a jetty about 2,370 feet long at the mouth. The finally revised estimate of cost is $105,000.

The amount expended to June 30, 1908, was $78,928.69, of which $4,008.71 was applied to maintenance subsequent to March 3, 1899. As a result of this expenditure the channel has been dredged to a depth of 9 feet at low tide, with a width of 140 to 150 feet, and redredged, and 1,570 linear feet of the jetty has been constructed; 169 feet on the inshore end of the jetty is for shore protection purposes only. The total amount of material dredged from the channel is about 136,000 cubic yards. There have been placed in the jetty about 4,600 cubic yards of stone and 3,000 cubic yards of oyster shells. The entire project is now about 80 per cent completed. No work of maintenance was done during the fiscal year ended June 30, 1908.

The maximum draft that could be carried on June 30, 1908, at mean low tide over the shoalest part of the locality under improvement was 9 feet. The mean range of tide is 1.8 feet.

The principal articles of commerce are farm produce, lumber, cord wood, fertilizer, grain, railroad ties, oysters, and general merchandise. The receipts and shipments during 1907 amounted to about 26,205 tons and were estimated to be worth about $739,823.

The work done has been of substantial benefit to navigation, and it is understood that freight rates have been considerably reduced and shipments much facilitated.

It is proposed to apply the additional appropriation recommended to the extension and maintenance of the jetty, and the dredging of the channel if required.

The additional work proposed is for the purpose of extension of benefits and for the preservation of the work already done.

A map of the locality may be found in the Annual Report of the Chief of Engineers for 1889.

For reference to a report on an examination and survey of Nomini Creek, see page 207 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1907, balance unexpended	$4,954.67
June 30, 1908, amount expended during fiscal year for works of improvement	4,883.36
July 1, 1908, balance unexpended	71.31
Amount (estimated) required for completion of existing project	30,008.71
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix K 6.)

7. *Rappahannock River, Virginia.*—The lower portion of the Rappahannock River is generally a wide and deep body of water, having the characteristics of a tidal estuary rather than of a fluvial stream.

The obstructions to navigation before improvement was undertaken consisted of nine bars in the upper portion of the river between Tap-

pahannock and Fredericksburg, over which the ruling depths were from 4 to 10½ feet. Seven of the bars were in the 12½ miles of river below Fredericksburg. Of these bars Fredericksburg bar, with a least depth of 4 feet, and Spottswood bar, 4 miles below Fredericksburg, with a least depth of 6 feet, caused the most delay to steamboats and vessels.

The project for this improvement, adopted March 3, 1871, as modified in 1879 and in 1905, provides for securing a channel 12 feet deep and 100 feet wide between Fredericksburg and Port Royal and 12 feet deep and 200 feet wide between Port Royal and the mouth of the river, this result to be obtained by dredging and the construction of dikes, the latter being also designed to secure the excavated material deposited behind them.

The total estimated cost of the revised project was $363,288.86, exclusive of work properly chargeable to maintenance and estimated in 1905 to cost $38,500. The project on which this estimate was based was adopted by Congress by act approved March 2, 1907. This act authorized an expenditure of $90,000 in excess of the amounts therein and theretofore appropriated. This makes the limit of cost of the revised project $393,633.12, including all necessary work properly chargeable to maintenance on June 30, 1907. The estimated annual cost for further maintenance is $10,000.

The amount expended to June 30, 1908, was $399,135.76, of which $86,906.05 has been applied to maintenance since March 3, 1899. The sum of $59,933.18 was expended prior to March 3, 1899, in redredging freshet deposits and in repairs to dikes.

The following sums have been obtained from other sources than appropriations: Damages recovered from contractor's sureties, $1,000, and proceeds of sale of property, $110; total, $1,110. This sum had not been expended at the close of the fiscal year.

The expenditure has resulted in the partial improvement of the 9 bars between Fredericksburg and Port Royal by means of dredging and rock excavation, construction of dikes, and removal of two wrecks which obstructed navigation. About 637,100 cubic yards of material has been dredged, 1,537 cubic yards of rock excavated, 28,009 linear feet of dikes constructed, 7,800 linear feet of dikes repaired, 675 linear feet of riprap dike constructed, and 1,214 cubic yards of riprap stone used.

The entire project is now about 75 per cent completed. The work carried on during the year resulted in partially restoring a previously dredged channel through Castle Ferry bar, in dredging a channel 40 feet wide and 10 feet deep through Snowden bar, in removing 5 snags at Snowden bar, in removing the wreck of a scow at Pollocks bar, in protecting the sand fills against erosion by freshets, and in the partial construction of dikes at the first 9 bars below Fredericksburg. Preparation for dredging the proposed channel through Mangoright bar was begun June 23, but no dredging was done during the fiscal year.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the locality under improvement was about 8 feet. The mean range of tide is about 3 feet. Fredericksburg, 106 miles above the mouth, is the head of navigation.

Dredging is to be carried on under a continuing contract. Of the sum authorized to be expended $32,000 still remains to be appropriated. In addition $10,000 per annum is required for maintenance.

The principal articles of commerce are railroad ties, lumber, farm produce, grain, cord wood, fertilizers, flour, canned goods, coal, manufactures, and general merchandise. The receipts and shipments during 1907 amounted to about 373,860 tons, and were estimated to be worth about $5,870,700.

The work done has been of benefit to commerce, and it is understood that freight rates have been reduced.

It is proposed to apply the additional appropriation recommended toward dredging and dike construction and completion of the project.

The additional work proposed is for the purpose of extension of benefits and maintenance of the work already done.

At Fredericksburg bar new deposits of sand are formed by each recurring freshet, and shoaling is also constantly taking place, though less rapidly, at some of the lower bars. This explains the estimate of $10,000 being required annually for maintenance.

Maps of this locality may be found in the Annual Reports of the Chief of Engineers for 1880, 1881, 1883, 1886, 1887, 1888, 1890, and 1906.

For reference to the report on an examination and survey of Rappahannock River, see page 208 of the Annual Report of the Chief of Engineers for 1904, and for the report of the survey submitting the revised project, see page 1110 of the Annual Report of the Chief of Engineers for 1906.

July 1, 1907, balance unexpended		$87,584.45
Amount appropriated by sundry civil act approved May 27, 1908		58,000.00
		145,584.45
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$42,128.67	
For maintenance of improvement	8,252.54	
		50,381.21
July 1, 1908, balance unexpended		95,203.24
July 1, 1908, outstanding liabilities		1,634.38
July 1, 1908, balance available		93,568.86
July 1, 1908, amount covered by uncompleted contracts		79,330.09
Amount (estimated) required for completion of existing project		40,252.54
Amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908:		
For works of improvement	$32,000.00	
For maintenance of improvement	30,000.00	
		62,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix K 7.)

8. Urbana Creek, Virginia.—Before the improvement of Urbana Creek, a tributary of the Rappahannock, a bar existed outside the mouth, over which but 6½ feet could be carried at low tide, and there was a shoal within the creek with a ruling depth of 7 feet.

The project for this improvement, adopted March 3, 1879, and modified in 1883, 1888, and 1897, provides for dredging a channel 150 feet wide and 10 feet deep through the outer and inner bars, with a turning basin of the same depth at the head, for a series of spur dikes at Bailey Point, and for a stone jetty to protect the cut through the outer bar. The final revised estimate of cost is $70,000.

The amount expended to June 30, 1908, was $43,139.41, of which $10,809.11 has been applied to maintenance since March 3, 1899. As a result of this expenditure there has been dredged a channel 10 feet deep and 150 feet wide through the outer bar, a channel 10 feet deep and 150 feet wide through the inner bar, and a turning basin 10 feet deep at the steamboat wharf. These channels have been redredged where shoaling had occurred.

Harbor lines have been established. Seven hundred and eighty-three linear feet of the jetty has been constructed. The total amount of material dredged from the channels is about 144,300 cubic yards. There has been placed in the jetty about 1,095.4 cubic yards of stone.

The work of maintenance during the fiscal year consisted in redredging a part of the channel through the inner bar, and in the examination of the Donaldson-Shultz wharf and of the bridge across Urbana Creek. The entire project is now about 60 per cent completed.

The maximum draft that could be carried on June 30, 1908, at mean low tide over the shoalest part of the locality under improvement was about 10 feet. The mean range of tide is 1.5 feet. The town of Urbana, at the mouth of the creek, is the head of navigation for steamers and large vessels, while small vessels ascend the stream for a distance of 3 or 4 miles.

The principal articles of commerce are lumber, oysters, cord wood, excelsior, ice, coal, farm produce, canned goods, railroad ties, bricks, pickles, and general merchandise. The receipts and shipments during 1907 amounted to about 23,779 tons, and were estimated to be worth $589,320.

The work done has been of benefit to commerce, and it is understood that freight rates have been reduced.

Work on this improvement was suspended between 1903 and 1907 pending the result of legal proceedings instituted by the Government to secure the removal of part of a wharf which projected into the proposed channel and which had been built in violation of the provisions of the act of March 3, 1899.

The owners finally agreed to alter the wharf in accordance with the requirements of the War Department and completed the work during the past year.

It is proposed to apply the additional appropriation recommended to the extension and maintenance of the jetty and the redredging of the outer bar if required.

The additional work proposed is partly for the extension of benefits and partly for the preservation of the work already done.

For reference to the reports on examinations and surveys of Urbana Creek, see page 210 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1907, balance unexpended		$9,893.44
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$4,574.39	
For maintenance of improvement	4,958.46	
		9,532.85
July 1, 1908, balance unexpended		360.59
Amount (estimated) required for completion of existing project		37,309.11
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		16,500.00

(See Appendix K 8.)

9. Harbor at Milford Haven, Virginia.—Milford Haven is a tidal estuary of Chesapeake Bay, about 4 miles long and from one-half to 1 mile wide. The depth in the channel ranges from 6½ to 15 feet, and in the portion navigated by steamers is generally 9 feet or more. The haven has two entrances, one at the northwest end from Hills Bay, an arm of Piankatank River, and another at the southeast end, from Chesapeake Bay. Both entrances are obstructed by bars. The southeast entrance is exposed, and as the bar has a ruling depth of but 3 feet is seldom used. The bar which obstructed the northwest entrance had, before improvement, a ruling depth of 8 feet. A bar also existed within the haven between Cricket Hill and Callis wharves, with a ruling depth of about 8 feet.

The project for this improvement, adopted March 3, 1899, and modified in 1902, provides for dredging channels 10 feet deep, with a minimum width of 200 feet, through the bar at the northwest entrance, and through the inner bar, at an estimated cost of $17,500.

The amount expended to June 30, 1908, was $20,361.51, none of which was applied to maintenance. The sum of $3,032.97 was recovered as judgment from a failing contractor. As a result of this expenditure channels of the full projected dimensions have been dredged through both bars, and a jetty 333 feet long has been constructed to maintain the outer channel. The total amount of material dredged from the channel is about 57,728 cubic yards. There has been placed in the jetty about 491 cubic yards of stone. The entire project is now completed.

The maximum draft that could be carried June 30, 1908, at mean low tide over the shoalest part of the locality under improvement was 10 feet. The mean range of tide is about 1.3 feet. The haven is navigable throughout its entire length by vessels drawing 6 feet, and Fitchett's wharf, about 3 miles above the northwest entrance, is the highest point reached by the large steamers.

The principal articles of commerce are oysters, fish, crabs, farm produce, fertilizers, piles, hay and feedstuffs, lumber, building materials, flour, ice, and general merchandise. The receipts and shipments during 1908 amounted to about 20,140 tons, and were estimated to be worth about $461,650.

The work done has been of considerable benefit to commerce and navigation. Freight rates have, however, been advanced.

The work contemplated in the project being completed, no further appropriation is asked for at present. It is anticipated that an ap-

propriation of about $4,000 every eight years will be required for maintenance.

For reference to reports on examinations and surveys of this locality, see page 211 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1907, balance unexpended	$2,558.84
June 30, 1908, amount expended during fiscal year for works of improvement	2,387.38
July 1, 1908, balance unexpended	171.46

(See Appendix K 9.)

10. James River, Virginia.—The original condition of the James, before its improvement by the General Government was begun in 1870, was as follows:

The ruling depth to the lower city line of Richmond was 7 feet at mean low water. This depth obtained on Rocketts reef, immediately below Richmond, and on Richmond bar, 2 miles below. Some 15 miles lower down, in Trents reach, was a shoal on which there was a depth of only 8 feet. This, however, ceased to be an obstruction in January, 1872, when the 5-mile reach in which it was situated was cut off by the opening of Dutch Gap Canal.

In addition to the above natural obstructions there were, in the 10 miles of river below Richmond, wrecks in the channel at Chaffins Bluff and Graveyard reach, and obstructions placed during the civil war at Warwick bar and Drewry Bluff, consisting at each locality of a military bridge, lines of stone cribs, and sunken vessels. In addition to all these obstructions, the channel between Richmond and Trents reach was in many places narrow and tortuous.

Between Trents reach and City Point, a distance of 18½ miles, the ruling depth was 13 feet, which obtained near Varina or Aikens Landing. Between City Point and the mouth of James River the ruling depth was 15 feet, existing at Harrisons bar and Goose Hill flats, then 43 and 76 miles, respectively, below Richmond.

It was contemplated in the original project, adopted in 1870, to secure a channel having a depth of 18 feet at high tide and a width of 180 feet. The amount expended prior to the adoption of the present project was $740,000.

The project under which the improvement is now being carried on was adopted July 5, 1884. It provided for the formation by means of regulation works and excavation of a channel between the mouth of the river and the lower city line of Richmond, having a depth of 22 feet at mean low tide, and a width from the mouth to City Point of 400 feet; thence to Drewry Bluff of 300 feet, and thence to Richmond of 200 feet, at a total estimated cost of $4,500,000.

The act of June 13, 1902, provided for extending the improvement from the lower city line of Richmond to the head of navigation at the docks, at an additional cost of $724,943.15. The work proposed under this extension consists of excavating a channel about 3,300 feet long and 200 feet wide, with a depth of 22 feet at mean low water.

By act of March 3, 1905, the original project was further extended to include the excavation of a turning basin at Richmond, by increasing the width of the proposed improved channel to 400 feet for a length of 600 feet, the depth to be 22 feet at a cost not to exceed

$150.000. This makes the total estimated cost of the improvement $5.374,943.15.

The amount expended on the present project to June 30, 1908, was $1,659,384.12, of which $54,351.92, expended subsequent to March 3, 1899, was for maintenance. This item of maintenance includes the cost of dredging sand deposited in the channel by the river during the execution of the work in excess of the quantity originally estimated, also repairs to jetties.

The improvement of the river has been chiefly confined to the upper reaches, where the water was shoalest, and consequently where the greatest benefits to commerce would be obtained. The exceptions to this were the dredging of shoals at Harrisons bar, Swans Point, and Goose Hill flats to a depth of 18 feet.

The project is estimated to be about one-third completed.

The result of the work of improvement is a channel between Hampton Roads and the city wharf at Richmond, Va., having, with few exceptions, a width of not less than 100 feet and a depth of 18 feet at mean low water. The exceptions are Rocklanding shoal, about 89 miles below Richmond, with a depth of 16.1 feet; Dancing Point shoal, about 60 miles below Richmond, with a depth of 16½ feet, and Willis, Varina, and Deep Bottom reaches, about 9 miles, 16 miles, and 18 miles, respectively, below Richmond, the respective ruling depths on which are 16.8, 17, and 17 feet.

The work of maintenance during the year consisted in redredging the channel near Richmond.

The maximum draft that could be carried at low water on June 30, 1908, between the city wharf at Richmond and the mouth of the river was 16.1 feet.

The mean tidal range varies for different parts of the river, being approximately as follows: 2½ feet at Fort Monroe, 1.85 feet at Jamestown, 3 feet at City Point, 3½ feet at Dutch Gap, and 4 feet at Richmond.

The channel length of the James River from Hampton Roads to the head of navigation at Richmond, Va., is 103.8 miles.

It is proposed to apply the available balance of funds to excavating part of the proposed turning basin at Richmond; to enlarging the channel for about 1½ miles from a point 800 feet below the city line of Richmond, and for some 1,600 feet from a point about 2½ miles below the same line; to extending the regulation works in the 5¾-mile reach below Richmond, and in Kingsland reach, 10 miles below. The appropriation recommended will be applied to maintain the improvement in the vicinity of Richmond, in widening the 18-foot channel immediately below Richmond, and excavating a 22-foot channel at Dancing shoal and Rocklanding shoal for the extension of benefits.

The commerce of the river for the calendar year of 1907 amounted to 301,860 tons at Richmond, Va., and 258,177 tons for landings below, or an aggregate of 560,037 tons, an increase of about 6 per cent over the tonnage of 1906. The value of the freight transported amounted to $32,957,000.

The principal articles of commerce comprised coal, coal oil, cord wood, lumber, fertilizer, and brick.

The improvement of the river has been beneficial in lowering railroad freight rates and in reducing the cost of river transportation.

Reports on examinations and surveys are found in Senate Executive Document No. 1, Thirty-third Congress, first session, Part 2, 1853, page 389, and in Annual Reports of the Chief of Engineers of 1875, page 74; of 1878, page 459; of 1882, page 870; of 1887, page 873; of 1890, page 996; of 1896, page 1010; and of 1900, page 1754.

More extended information concerning the improvement is contained in Annual Reports of the Chief of Engineers of 1871, pages 603 to 605; of 1882, pages 870 to 887; and of 1900, pages 1757 to 1760.

Maps of James River are contained in the Annual Reports of the Chief of Engineers for 1876, 1900, and 1904, and in House Document No. 234, Fifty-sixth Congress, first session.

GENERAL IMPROVEMENT.

July 1, 1907, balance unexpended		$318,179.76
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$78,466.09	
For maintenance of improvement	11,594.92	
		90,061.01
July 1, 1908, balance unexpended		228,118.75
July 1, 1908, outstanding liabilities		1,657.13
July 1, 1908, balance available		226,461.62
July 1, 1908, amount covered by uncompleted contracts		196,914.03
Amount (estimated) required for completion of existing project		3,546,462.57
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		400,000.00

TURNING BASIN.

July 1, 1907, balance unexpended	$50,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	49,670.37
July 1, 1908, balance unexpended	329.63
July 1, 1908, amount covered by uncompleted contracts	329.63

(See Appendix K 10.)

11. Construction of piers, Hampton Roads, Jamestown Exposition.—Along the water front of the Jamestown Exposition there is a sand beach with a very gradual slope. The distance from the shore line out to the 10-foot contour is about 5,000 feet and the distance to the 12-foot contour about 7,000 feet. At a distance of about 11,000 feet there was an outer bar with a maximum depth of about 8 feet. The locality is sufficiently exposed to render an artificial harbor necessary if small boats are to land during bad weather. In Bush Creek the average depth over the area to be dredged was about zero at mean low water.

The original project was adopted by act of Congress, approved June 30, 1906, and provided for the construction, from plans furnished by the Jamestown Exposition Company and approved by the Secretary of War, of two piers extending from the exposition grounds into the waters of Hampton Roads, the piers to be connected at their outer ends by an arch sufficiently high to permit small craft to enter

under it into a basin or harbor to be dredged to a sufficient depth to accommodate boats drawing not more than 10 feet at mean low tide, at a total cost not to exceed $400,000.

This project was modified by act of Congress approved February 9, 1907, which provided, in addition to the work described above, for dredging a channel from deep water in Hampton Roads to the Government piers at the Jamestown Exposition, and for dredging in Bush Creek to accommodate the needs of the life-saving exhibit, at a cost not to exceed $65,000.

Actual construction work on the piers was begun during December, 1906, and was pushed continuously from that time until the date of completion. At the close of the fiscal year 1907 the work on the piers proper had been about 84 per cent completed. The dredging in Bush Creek had been completed and the dredging in the channel of approach to the piers had been about 68 per cent completed.

Work during the fiscal year 1908 consisted in dredging, filling, construction of approaches to the arch and steps over the arch, in closing the gap east of the arch and in completing the carpentry and staff work.

The dredging in the channel of approach and basin and the fills were completed during August, 1907, and all work had been practically completed by September 14, 1907, the date upon which the entire pier was opened to the public.

The total amount expended to date is $446,583.04, and in addition to this sum $1,000, retained in lieu of a guaranty bond, will be due the contractors one year after the completion of the work (September 14, 1908), provided their roof work remains tight until that time. On September 14, 1907, the piers were transferred to the Jamestown Exposition Company, in accordance with the terms of the act of Congress.

July 1, 1907, balance unexpended	$204,263.80
June 30, 1908, amount expended during fiscal year	185,846.84
July 1, 1908, balance unexpended	18,416.96
July 1, 1908, amount covered by uncompleted contracts	1,000.00

(See Appendix K 11.)

12. Permanent landing pier at Jamestown Island, Virginia.—By act of Congress approved June 30, 1906, $15,000 was appropriated for erecting a permanent landing pier at Jamestown Island, Virginia, on the frontage owned by the Association for the Preservation of Virginia Antiquities, the necessary land for the pier to be donated to the United States by the association; or else the money was to be used for the purchase or lease of any suitable wharf at the island and a sufficient and proper amount of land adjacent thereto to give free access to the grounds of the association and the monument being erected by the Government.

No work was done during the fiscal year 1908, and as it was found impossible to comply with the terms of the law, by direction of the Secretary of War, the balance of the appropriation available was covered into the Treasury on September 13, 1907.

July 1, 1907, balance unexpended	$14,661.44
July 1, 1908, balance unexpended (covered into Treasury)	14,661.44

(See Appendix K 12.)

13. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Wreck of Steamer W. W. Corcoran in Potomac River at Washington.*—This wreck was encountered during the tearing down of the old Long Bridge across the Potomac River, and was reported as an obstruction to navigation on July 17, 1907.

The wreck was blasted and removed from the river with derricks and a dredge hired for the purpose between August 6 and September 10. 1907, except the boiler, which was sold while in the river and was removed October 28, 1907.

The cost of the work was $1,900.

(*b*) *Wreck of scow No. 1 at Upper Mud bar, Occoquan Creek, Virginia.*—This wreck was reported as an obstruction to navigation on August 17, 1907.

Between August 29 and September 9, 1907, the scow was raised and towed to Washington, D. C., where it was repaired for use on various improvements in this district.

The cost of the work was $350.

(*c*) *Wreck of dredge City of Richmond in James River at Richmond, Va.*—This wreck was reported as an obstruction to navigation January 5, 1907, and an examination promptly made.

The wreck was broken up by dynamite and its removal completed October 5, 1907, under contract.

The cost of the work was $2,700.

(*d*) *Wreck of a scow in Occoquan Creek, Virginia.*—This wreck was observed during dredging operations early in April and was reported on April 10 to constitute an obstruction to navigation. It was removed between May 26 and 31, 1908, at a cost of $250.

(*e*) *Wreck of barge in Alexandria Harbor, Virginia.*—During the examination of the harbor of Alexandria certain persons stated that in their opinion the wreck of a barge was the cause of the shoaling along the water front of Alexandria, Va.

Work was begun on June 15, 1908, under contract and was prosecuted throughout the year. It was about 25 per cent completed on June 30, 1908.

Nothing of value was obtained.

The expenditures during the year, incidental to this work, were $75.33.

(*f*) *Seven wrecks on the flats of the Anacostia River.*—Seven abandoned coal barges, canal boats, etc., have been beached for several years on the flats of Anacostia River, near the outlet of James Creek Canal. Two of these barges were floated on high water during May across the Anacostia River and lodged on the riprap wall of the area to be reclaimed.

In order that the remaining five barges should not under like circumstances be floated and become a menace to navigation, their destruction has been authorized.

The two barges that had floated across the Anacostia were burned to the water's edge. No work has been yet done on the other wrecks.

There were no expenditures under this allotment during the fiscal year 1908.

(*g*) *Wreck of pile driver in the Pamunkey River, Virginia.*—By letter dated May 11, 1908, Mr. H. T. Faunt Le Roy reported the existence of a sunken pile driver at Cumberland Landing on the Pamunkey River at a point where the river was narrow and currents

unfavorable, the wreck thus constituting a "great menace to navigation."

Subsequent correspondence and examinations established the fact that the party responsible for this wreck was Mr. E. Wilkinson, of West Point, Va. An unsuccessful attempt to raise the wreck was made by Mr. Wilkinson on June 9, 1908.

Steps have been taken to mark it by day and light it by night in case Mr. Wilkinson fails to do so. Removal of this wreck has been authorized, but no work was done during the fiscal year and no expenditures were made.

The total expenditure during the year on the removal of wrecks in this district was $5,275.33.

(See Appendix K 13.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination of Horn Harbor, Virginia.*—Report dated July 25, 1907, is printed in House Document No. 396, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. *Preliminary examination of Queens Creek, Virginia, from its mouth to Capital Landing bridge.*—Report dated August 2, 1907, is printed in House Document No. 446, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

3. *Preliminary examination of Totuskey River, Virginia.*—Report dated July 29, 1907, is printed in House Document No. 451, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

4. *Preliminary examination of Patuxent River, Maryland.*—Report dated July 15, 1907, is printed in House Document No. 531, Sixtieth Congress, first session. The locality is not considered worthy of further improvement by the General Government at this time.

5. *Preliminary examination and survey of Potomac River, with a view to obtaining a channel to the wharf at Mount Vernon, Virginia.*—Reports dated June 19 and December 26, 1907, respectively, are printed in House Document No. 654, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $11,000 is presented.

6. *Preliminary examination and survey of Potomac River below Washington, D. C., with a view to obtaining a width of channel of 400 feet.*—Reports dated August 12, 1907, and January 24, 1908, respectively, are printed in House Document No. 859, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $204,000 is presented.

7. *Preliminary examination and survey of Potomac River, with a view to obtaining a greater depth to Lower Cedar Point, Maryland.*—

Reports dated July 26 and December 13, 1907, are printed in House Document No. 918, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $13,300 is presented.

8. Preliminary examination and survey of Aquia Creek, from Coal Landing to Wharton Landing, Virginia.—Reports dated September 25, 1907, and January 17, 1908, are printed in House Document No. 964, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

The local officer was also charged with the duty of making a preliminary examination and survey of *Potomac River at Alexandria, Va.*, provided for in the river and harbor act of March 2, 1907, and reports thereon will be duly submitted when received.

IMPROVEMENT OF RIVERS AND HARBORS IN THE NORFOLK, VIRGINIA, DISTRICT.

This district was in the charge of Maj. Joseph E. Kuhn, Corps of Engineers, having under his immediate orders Capt. E. D. Peck, Corps of Engineers, from December 4, 1907, to March 31, 1908. Division engineer, Lieut. Col. Dan C. Kingman, Corps of Engineers.

1. Harbor at Norfolk and its approaches, Virginia.—(*a*) *General improvement.*—In its original condition the main channel of this harbor was at mean low water navigable by vessels of 20 feet draft as far as the navy-yard, on the Southern Branch of the Elizabeth River, while in the Eastern Branch of this river there was a channel 15 feet in depth at mean low water as far as the Campostella bridge. These channels were of varying width.

The original project of improvement was adopted in 1878, revised in 1885, and amended in 1890, 1898, and 1905. It included the attainment of a channel from 500 to 700 feet wide and 25 feet deep at mean low water from Hampton Roads to the navy-yard, a branch channel 22 feet deep at the same stage of the tide to the Campostella bridge on the Eastern Branch, and, within the limits of the first-named channel, a channel 450 feet wide and 28 feet deep at mean low water from deep water in Hampton Roads to the navy-yard. There has also been included in the project the excavation of an anchorage at the mouth of the Western Branch, having an area of 56 acres and a depth of 25 feet at mean low water, and the dredging, to the depth of 28 feet at mean low water, of the area between the western edge of the main channel and a line 75 feet outside of the established pierhead line, along the railroad docks at Pinner Point. The cost of all this work was estimated at $1,623,790.98.

The existing project of improvement is the original project modified from time to time as stated above.

To June 30, 1908, there had been expended on this existing project $1,665,999.25, of which sum $51,052.16 was for work of maintenance. The sum of $21.21 has been derived from the sale of property and blueprints.

On June 30, 1908, the project is about 99.5 per cent completed, the only work remaining to be done being the dredging of a strip 20 feet wide and 2,600 feet long from the south side of the channel in the Eastern Branch between the Norfolk and Western Railroad and Campostella highway bridges, for which purpose the estimate for completion has been increased by $5,000.

On June 30, 1908, the main channel of the harbor was available at mean low water for vessels of 28 feet draft as far as the navy-yard, which is located about 10 miles from deep water in Hampton Roads. The Eastern Branch channel is available at mean low water for vessels drawing 22 feet as far as the Campostella bridge, about 11 miles from deep water in Hampton Roads. The normal range of the tide is 2.7 feet.

The Southern Branch of the Elizabeth River is navigable as far as the Albemarle and Chesapeake Canal locks, a distance of about 11 miles above the confluence of the Eastern and Southern branches of this river. The Eastern Branch is navigable for about 5 miles above this confluence. From this confluence to deep water in Hampton Roads the distance by the main river is about 9 miles.

For the calendar year 1907 the water-borne shipments aggregated about 13,643,849 tons, valued at about $597,950,881.43. The chief products handled are coal, cotton, fertilizer, lumber, and agricultural products. The improvement has made Norfolk an important shipping point for bituminous coal from the West Virginia fields, and a new railroad, the Virginian, is nearing completion and will soon engage in the business of shipping cargo and bunker coal from a deep-water pier on the Elizabeth River.

It has not been found practicable to ascertain what effects, if any, the improvement has had on freight rates.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1910, will be applied to widening the channel in the Eastern Branch between the Norfolk and Western and the Campostella highway bridges, by 20 feet, in order to complete the project and to extend its benefits.

For more extended information and maps, see Reports of Chief of Engineers for 1880, page 815; 1885, page 1018; 1887, page 969, and 1893, page 1323. For reference to examinations and surveys, see Report of Chief of Engineers for 1906, page 238.

July 1, 1907, balance unexpended	$41,485.59
Received from sales	10.50
	41,496.09
June 30, 1908, amount expended during fiscal year for works of improvement	37,632.71
July 1, 1908, balance unexpended	3,863.38
July 1, 1908, outstanding liabilities	3,453.20
July 1, 1908, balance available	410.18
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	5,000.00

(*b*) *Hospital Point.*—The land of this point is the property of the United States, and is a part of the grounds used by the Navy Department as a site for a hospital. The main channel of Norfolk Harbor passes in front of and close to this point.

The project for this work, adopted in 1902, required the cutting off of 450 feet of the point, the construction of a sea wall and wharf, and the dredging of the area on both sides of the old point. The depth to be secured in the dredging was to be the same as that of the harbor—25 feet at mean low water. The estimated cost of the work was $193,957, all of which has been appropriated.

On June 30, 1908, the expenditures had amounted to $187,564.61, and had resulted in the completion of the project. It is proposed to utilize the available balance of the appropriation in maintaining the improvement.

The statements in the previous section of this report regarding the character and volume of the commerce affected by the improvement of Norfolk Harbor, and as to the tidal range, state of navigability of the harbor, and the effect of the improvement on freight rates apply to this section also.

A report upon an examination of this work will be found at page 964, Annual Report of the Chief of Engineers for 1889; and in the report for 1897, page 1335 et seq., full details of the project, with maps explanatory thereof, are given.

July 1, 1907, balance unexpended	$6,392.39
July 1, 1908, balance unexpended	6,392.39

(*c*) *Thirty-foot channel.*—As noted in section (*a*) above, the existing ship channel affords a 28-foot navigation, 450 feet wide, from Hampton Roads to the junction of the Southern and Eastern branches.

Under a project adopted March 2, 1907, the existing ship channel is to be deepened to 30 feet and to be given a width of 600 feet from Hampton Roads to Lambert Point and 800 feet from Lambert Point to the junction of the Eastern and Southern branches of the Elizabeth River. This project also includes the removal of the shoals at the mouth of the Eastern Branch to a depth of 25 feet and a width of 500 feet. The estimated cost of the project is $1,132,000.

The expenditures to June 30, 1908, have amounted to $88,765.91.

This project is in progress under a continuing-contract authorization for which the sum of $725,000 still remains to be appropriated.

On June 30, 1908, the project was about 13 per cent completed. The work accomplished consisted in the removal of the shoals at the mouth of the Eastern Branch and in the partial excavation of the new 30-foot channel between Lambert Point and Craney Island light. Work on the new 30-foot channel has not yet progressed sufficiently to determine its effect upon commerce.

The statements contained in section (*a*) above, regarding the character and volume of commerce, tidal range, and state of navigability of the channel apply to this section also.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1910, will be applied to dredging under the existing project for the purpose of extending the benefits of the improvement.

Reports, with maps, upon examinations of this improvement will be found in House Documents Nos. 373 and 381, Fifty-ninth Congress, first session.

July 1, 1907, balance unexpended	$281,017.16
Amount appropriated by sundry civil act approved May 27, 1908	125,000.00
	406,017.16
June 30, 1908, amount expended during fiscal year for works of improvement	87,783.07
July 1, 1908, balance unexpended	318,234.09
July 1, 1908, outstanding liabilities	9,825.38
July 1, 1908, balance available	308,408.71
July 1, 1908, amount covered by uncompleted contracts	500,309.23
Amount (estimated) required for completion of existing project	725,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix L 1.)

2. *Western Branch of Elizabeth River, Virginia.*—The channel of the river, when the project for improvement was adopted, was 12 feet deep at mean low water and from 50 to 300 feet wide.

The project adopted in 1896 provided for obtaining, by dredging, a channel 200 feet wide and 20 feet deep at mean low water for a distance of about 1 mile from deep water in Norfolk Harbor. The estimated cost was $45,000, all of which has been appropriated.

Up to June 30, 1908, the sum of $44,671.65 has been expended on this improvement, the result being the completion of the project.

It is proposed to utilize the available balance in maintaining the improvement.

A draft of 19 feet at mean low water can be carried in the improved channel. The average rise and fall of the tide is 2.7 feet.

This stream is navigable for small sailboats to farms situated about 9 miles from its mouth.

The commerce in the main consists of manufactured lumber, ore, and farm products. For the calendar year 1907 it is reported to have amounted to 2,487,113 tons, valued at $25,800,517.50.

It has not been found possible to ascertain what effect, if any, the improvement has had upon freight rates.

The amount estimated for profitable expenditure during the fiscal year ending June 30, 1910, will be applied in maintaining the improvement by dredging, to restore the channel to project width and depth.

For reference to list of reports on examinations of this stream, see Report of the Chief of Engineers for 1906, page 240.

July 1, 1907, balance unexpended	$328.35
July 1, 1908, balance unexpended	328.35
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix L 2.)

3. Hampton Roads, Virginia.—Before improvement, vessels of more than 25 feet draft could not reach Newport News on account of the shoal in Hampton Roads, known locally as Middle Ground bar.

Under an item in the act of June 13, 1902, provision was made for dredging a channel through the Middle Ground bar 500 feet wide and 30 feet deep at mean low water. The estimated cost of the work was $225,000.

Up to June 30, 1908, $225,083.91 had been expended on the work, and the project had been completed. The expenditures for the fiscal year were applied to surveying and office expenses, $83.91 of which was under maintenance.

On June 30, 1908, vessels of 30 feet draft could navigate the channel safely, but there are signs of deterioration in the channel, and dredging will be required to maintain the project depth and width. The average tidal range is 2.5 feet.

The head of navigation via this channel is at Richmond, Va., on the James River, a distance of about 105 miles up the river.

The amount of commerce when the improvement was undertaken in 1902 amounted to 2,663,669 tons. For the calendar year 1907 it is reported to have amounted to 6,379,617 tons, valued at $511,179,734.70. The bulk of the tonnage is in coal and grain.

It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

It is proposed to expend the available balance and the amount estimated as a profitable expenditure for the fiscal year ending June 30, 1910, in maintaining the project depth and width of channel for the purpose of keeping the improvement available.

For reference as to reports on examinations and surveys, see Report of the Chief of Engineers for 1906, page 240.

July 1, 1907, balance unexpended		$12,556.49
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$56.49	
For maintenance of improvement	83.91	
		140.40
July 1, 1908, balance unexpended		12,416.09
July 1, 1908, outstanding liabilities		.75
July 1, 1908, balance available		12,415.34
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		12,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix L 3.)

4. Nansemond River, Virginia.—The original channel of this stream permitted it to be navigated at mean low water by vessels drawing not more than 5 feet. The depth was increased to 8 feet at the same stage of tide under appropriations made between 1873 and 1878 at a cost of $37,000.

The project under which the work has been carried on until recently was adopted August 11, 1888, and called for a channel 100 feet wide from Suffolk, the head of navigation, to the Western Branch, while from the latter place to Town Point its width was to vary from 200

to 400 feet. The depth to be obtained throughout was 12 feet at mean low water. This improvement was estimated to cost $152,500.

At present it is contemplated to provide a channel only 80 feet wide and 12 feet deep at mean low water between Suffolk and Town Point, which is now deemed ample for the commerce of the stream.

Up to June 30, 1908, the expenditures under the project of 1888 and its modification have amounted to $49,960.16, of which amount $9,283.05 has been applied to maintenance. The channel between Suffolk and the Western Branch has been dredged to 80 feet in width and 12 feet in depth at mean low water, and a turning basin has been excavated at the former place. The project is about 67 per cent completed.

The amount reported as expended during the fiscal year for maintenance was applied toward the expense of a survey to determine the condition of the channel at certain bars in the vicinity of the Western Branch.

At the close of the fiscal year a boat drawing 11 feet at mean low water could reach Suffolk, the head of navigation, 18 miles above the mouth of the river. The tidal variations are about 3 feet at Town Point and 3.8 feet at Suffolk.

The commerce of the stream consists principally of lumber, agricultural products, and merchandise. In 1890 it is reported to have reached about 220,000 tons. For the calendar year 1907 it is reported to have amounted to 156,200 tons, valued at $4,360,749.

It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1910, will be applied toward repairing a portion of the timber-training dike at the mouth of the Western Branch for the purpose of maintaining the improvement at this point.

For reference to list of reports of examinations and surveys, see Report of Chief of Engineers for 1906, page 241.

July 1, 1907, balance unexpended	$5,053.39
June 30, 1908, amount expended during fiscal year for maintenance of improvement	13.55
July 1, 1908, balance unexpended	5,039.84
Amount (estimated) required for completion of existing project	7,769.50
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix L 4.)

5. *Pagan River, Virginia.*—Originally the shoals in this stream limited the draft of vessels to 6½ feet at mean low water. Under a project adopted in 1880 the sum of $10,000 was expended in dredging a channel 60 feet wide and 8 feet deep at mean low water through three shoals between the mouth and Smithfield, Va.

The project upon which was based the appropriation of $10,870 in the act of June 13, 1902, provided for obtaining a channel from Smithfield to the mouth of the river 80 feet wide and 8 feet deep at mean low water. The estimated cost was $28,870. This project was

modified by the act of March 3, 1905, which authorized the expenditure of the balance remaining of the appropriation of 1902 in securing a channel not less than 40 feet wide and of such depth as might be obtained without exceeding said balance. In the project submitted under the above-cited provision of law it was stated that the unexpended balance would provide such a channel 10 feet in depth at mean low water.

Up to June 30, 1908, the expenditures had amounted to $10,671.01, and the project had been completed.

There is now a navigable channel 40 feet wide and 10 feet in depth at mean low water from the mouth of the river for a distance of about 9 miles to Smithfield, the head of navigation. The average range of the tide is 2.6 feet.

The commerce is handled by numerous small schooners and sloops and two regular steamers, and consists largely of peanuts and oysters.

The commerce of this stream has averaged about 100,000 tons a year, but has varied considerably from year to year according to whether conditions have or have not been favorable to the production of peanuts and oysters. For the calendar year 1907 it is reported to have amounted to 89,289 tons, valued at $13,260,101.25.

It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

Reports upon examinations and surveys of this river will be found in the Annual Report of the Chief of Engineers for 1875, Part 2, page 156, and for 1901, page 1174. Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 280 of this report.

July 1, 1907, balance unexpended	$198.99
July 1, 1908, balance unexpended	198.99

(See Appendix L 5.)

6. Appomattox River, Virginia.—(a) Maintenance.—The original channel in this river was narrow and tortuous, and numerous shoals prevented vessels drawing more than 6½ feet from navigating it at mean high water.

The original project, which is also the existing project, was adopted in 1871 and revised in 1893. The project as revised covers the attainment and maintenance of a channel 80 feet wide and 12 feet deep at mean high water between Point of Rocks and Petersburg. The cost of providing this channel was estimated at $471,920 and its maintenance at $10,000 annually.

On June 30, 1908, the sum of $424,571.10 had been expended toward the improvement and the sum of $49,234.97 for maintenance.

The amount reported as expended during the fiscal year was applied toward the expense of a resurvey of the channel and to the preparation of a contract for dredging. The project is about 85 per cent completed.

At the present time the channel of the river is available at high water for vessels of about 8 feet draft, the normal range of the tide being about 2.6 feet. The head of navigation is Petersburg, Va., about 11 miles from the mouth of the river.

The commerce consists of lumber and miscellaneous products. In 1890 it amounted to about 20,000 tons. It gradually increased until in 1900 and 1901 it amounted to about 150,000 tons. Since then it

has decreased, and for the calendar year 1907 it is reported to have been the same as the previous calendar year, about 30,000 tons.

It is proposed to expend the balance now available in removing material brought down by freshets and deposited in the navigable channel of the river. This work is required to render the navigable channel available in the interests of commerce. Work will be commenced early in the next fiscal year, a contract having been awarded for the work.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1910, will be applied toward the removal of material deposited in the navigable channel by freshets, for the purpose of maintaining the improvement.

An examination of this stream was made in 1852, to which reference is made in the Annual Report of the Chief of Engineers for 1870, page 68. A survey was made in 1870 and the report published in the Annual Report of the Chief of Engineers for that year, commencing at page 68. Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 280 of this report.

July 1, 1907, balance unexpended	$49,933.33
June 30, 1908, amount expended during fiscal year for works of improvement	741.10
July 1, 1908, balance unexpended	49,192.23
July 1, 1908, amount covered by uncompleted contracts	30,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(*b*) *At Petersburg.*—The project for the work contemplated is not to provide a navigable channel, but to excavate a new channel into which to deflect the river, and thus overcome the trouble experienced by the deposit of sediment in the navigable channel of the river in the neighborhood of Petersburg.

The project for this work, which was adopted June 13, 1902, contemplates the excavation to mean low water of a cut from 200 to 300 feet wide and 2½ miles long and the diversion of the river into the said cut by means of a dam built across the present channel at the head of the harbor of Petersburg, and includes the construction of bridges for the highways and railway crossing the new channel and other incidental work. The estimate for the work is $200,000, which amount has been provided.

At the close of the fiscal year 1908 the sum of $135,181.59 had been expended, all of the land needed has been purchased, the highway and railway bridges have been built, the new cut has been partially excavated, and the dam across the Appomattox River built to low water. The expenditures during the fiscal year were applied to payment for work done under contract. The project is about 75 per cent completed.

It has not been found possible to ascertain what effect, if any, the improvement has had upon freight rates.

The balance of funds will be applied to completing the work under the adopted project.

The commerce to be affected by the improvement contemplated is the same as that mentioned in the preceding section, and all general statements made therein apply equally well to this section.

A report upon an examination and survey will be found in the Annual Report of the Chief of Engineers for 1882, page 907. Another report, with a map, will be found in the Report of the Chief of Engineers for 1889, page 957. Other reports will be found in the Annual Reports of the Chief of Engineers for 1893, page 1345, and for 1901, page 1467.

July 1, 1907, balance unexpended	$97,957.92
June 30, 1908, amount expended during fiscal year for works of improvement	33,139.51
July 1, 1908, balance unexpended	64,818.41
July 1, 1908, outstanding liabilities	4,386.44
July 1, 1908, balance available	60,431.97
July 1, 1908, amount covered by uncompleted contracts	42,434.76

(See Appendix L 6.)

7. *Harbor at Cape Charles City, Va.*—The harbor proper is landlocked and covers an area of 10 acres, and it and the exposed channels leading thereto had, before the beginning of the work, a depth of 12 feet at mean low water.

The project was adopted in 1890 and requires the dredging of a channel through Cherrystone Inlet and bar 100 and 200 feet wide, respectively, and 16 feet deep at mean low water, the dredging of an entrance channel 100 feet wide of the same depth, and dredging over the entire area of the protected and inclosed harbor to a depth of 14 feet at mean low water. Jetties of stone were to be constructed for the protection of the channel leading into the basin. This work was estimated to cost $142,340.

The expenditures to June 30, 1908, amounted to $94.598.89, and resulted in the dredging and redredging of one-half of the inner harbor to the proper depth and the excavation of channels of the required dimensions through the inlet and the entrance to the basin and the construction of 875 feet of the north jetty and 232 feet of the south jetty. The north jetty is 1,625 feet in length, but 750 feet of this was built without expense to the United States. The project is about 70 per cent completed.

On June 30, 1908, a vessel drawing 12 feet could enter the harbor at mean low water. The docks within the landlocked harbor are about 3 miles from the 16-foot contour in Chesapeake Bay at Cherrystone bar. The range of the tide is about 2.5 feet.

The commerce consists mainly of miscellaneous freight, agricultural products, fertilizer, and some oysters and fish. At the beginning of the improvement the annual commerce was about 400,000 tons. For the calendar year 1907 it is reported to have amounted to 2,121,301 tons, valued at $4,559,440. It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1910, will be applied to dredging a channel

across Cherrystone bar to extend the benefits of the improvement and in redredging the entrance channel to the harbor for the purpose of maintaining the channel.

For more extended information, see Annual Report of the Chief of Engineers for 1890, page 975.

July 1, 1907, balance unexpended	$41,237.57
June 30, 1908, amount expended during fiscal year for works of improvement	10,836.46
July 1, 1908, balance unexpended	30,401.11
July 1, 1908, outstanding liabilities	2,991.27
July 1, 1908, balance available	27,409.84
July 1, 1908, amount covered by uncompleted contracts	17,947.59
Amount (estimated) required for completion of existing project	17,340.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	25,000.00

(See Appendix L 7.)

8. *Waterway from Norfolk, Va., to the sounds of North Carolina.*—This waterway extends from Norfolk, Va., via the Southern Branch of the Elizabeth River to Deep Creek, thence through the Dismal Swamp Canal to South Mills, N. C., and from the latter point through Turners Cut to the Pasquotank River, to Albemarle Sound, and thence to Pamlico Sound by Croatan Sound.

The draft which could be carried through this waterway at the time of the adoption of the project for improvement was limited to 2½ feet at mean low water, owing to the deterioration of the Dismal Swamp Canal, which originally had had a depth of about 6 feet.

The project, adopted March 3, 1899, provides for the dredging of channels in Deep Creek, Turners Cut, through a shoal in the Pasquotank River near Ship Yard bar, and through a bar in Croatan Sound near Croatan light. All these channels, except the last named, were to be 100 feet wide and 10 feet deep at mean low water. The Croatan channel was to be 200 feet wide and 12 feet deep at mean low water. For the protection of these channels sheet piling was to be driven where necessary. The estimated cost of this work was $274,310.

Up to June 30, 1908, the sum of $251,196.46 had been expended on the project and $6,853.14 on its maintenance. The project has been completed, and the additional work required is for maintenance.

The amount reported as expended during the fiscal year for maintenance was applied toward repairing sheet-pile revetment in Turners Cut and toward expenses of inspections of the water route made from time to time.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1910, will be applied toward removal of obstructions and toward dredging in Deep Creek for the purpose of maintaining the improvement.

On June 30, 1908, vessels drawing 10 feet of water can at mean low water navigate from Norfolk, Va., through all sections of the route which have been improved by the United States. The canal,

which extends from Deep Creek to South Mills, is maintained at the expense of a private corporation, which tries to keep it available for vessels of 10 feet draft, but on June 30, 1907, the limiting depth for the entire route was only 9 feet, owing to the existence of shoal places in the canal. Deep Creek is the only tidal portion of the improvement, and there the rise and fall averages 3 feet. In the other sections the water level changes according to the direction and velocity of the wind. The route is about 67 miles in length.

The commerce for the calendar year 1907 is reported to have amounted to 366,339 tons, valued at $4,559,440. The main items of commerce are coal, fertilizer, timber, and farm products.

It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

For list of reports of examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 246.

July 1, 1907, balance unexpended	$5,043.22
June 30, 1908, amount expended during fiscal year for works of improvement	222.82
July 1, 1908, balance unexpended	4,820.40
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix L 8.)

9. Inland water route from Norfolk, Va., to Albemarle Sound, North Carolina, through Currituck Sound.—This route extends from Norfolk, Va., to Albemarle Sound, via the Southern Branch of the Elizabeth River, Albemarle and Chesapeake Canal, North Landing River, Currituck Sound, Coanjock Bay, North Carolina Cut, and North River. The canal and cut mentioned are now controlled by a private corporation.

This route had originally a good 5-foot mean low-water channel, but navigation was obstructed by snags, sunken logs, and overhanging trees. Sharp bends added to the other difficulties of navigation.

Until the act of September 19, 1890, the work of improvement was carried on under several separate projects, upon which a total of $240,169.69 had been expended. By that act all these projects were consolidated.

The present project, adopted September 19, 1890, provides for obtaining a channel 80 feet wide and 9 feet deep at mean low water through the whole extent of the waterway to be improved by the United States, at an estimated cost of $306,667.08, including the previous expenditures above mentioned. The project is considered as complete, the additional work required being for maintenance. Since September 19, 1890, and up to June 30, 1908, the sum of $61,987.64 has been expended upon this improvement and $31,756.20 upon maintenance. The expenditures during the fiscal year were applied to maintenance. The work consisted in keeping the waterway clear of sunken logs and stumps.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1910, will be applied in maintaining the improvement by keeping the various channels clear of logs, snags, and

similar obstructions, and in redredging parts of the channel through Currituck Sound where these have deteriorated.

The channels through the various portions of the route are now from 60 to 80 feet wide and have a depth of 9 feet at mean low water. The draft of vessels which can pass through the route at mean low water on June 30, 1908, is 9 feet. The route is about 67 miles long.

There is no lunar tide in any portion of the route, except in the Southern Branch of the Elizabeth River, where the average rise and fall is 2.7 feet. In the other sections the water level varies according to the velocity and direction of the wind, for which an allowance of 0.5 foot is made, but severe storms may cause an elevation or depression of 2 feet or more.

The commerce has varied considerably since the route was opened to navigation. The highest reported was for the calendar year 1890, when it amounted to 403,111 tons. Since that time it has decreased considerably, and for the calendar year 1907 it amounted to 188,543 tons, value not known. The principal items of shipment consist of coal, fertilizer, and timber products.

The gradual decrease in the commerce of the route is due to the depletion of the forests and the consequent decrease in timber shipments.

It has not been found possible to ascertain what effect, if any, the improvement has had upon freight rates.

Considerable difficulty is experienced in keeping this waterway free from obstructions by logs dropped from rafts due to the improper construction of the rafts, and, in the absence of any adequate laws permitting the Engineer Department to control the construction of rafts, it has been found impossible to prevent the frequent occurrence of these obstructions.

For references as to examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 247.

July 1, 1907, balance unexpended	$3,233.91
Received from sales during fiscal year	26.75
	3,260.66
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,433.50
July 1, 1908, balance unexpended	1,827.16
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix L 9.)

10. Perquimans River, North Carolina.—Before work was begun navigation was obstructed by numerous stumps just below the town of Hertford, N. C., which limited the draft of vessels to 7 feet.

The first appropriation for the Perquimans River was made in 1876, and was based on a project to provide a channel 200 feet wide with a depth of 9½ feet at mean low water through a stumpy reach near Hertford, N. C., and the amount provided ($2,500) was expended in obtaining said channel, which was completed in 1877.

The existing project, adopted by Congress March 3, 1905, was to provide a channel 200 feet wide and 9 feet deep at mean low water through the stumpy reach about 800 feet below Hertford, N. C., at an estimated cost of $11,250.

To June 30, 1908, $11,168.06 had been expended, and all the work contemplated has been completed.

On June 30, 1908, vessels drawing 9 feet can, at mean low water. reach the town of Hertford.

There is no lunar tide in the river, the level of the surface of the water varying according to the direction and velocity of the wind. The average difference in elevation is about one-half foot, but storms may cause a difference of as much as 2 feet or more. The head of navigation is at Newby's bridge, about 26 miles from the mouth of the river.

An estimate in 1902 placed the commerce at about 36,000 tons, and for the calendar year 1907 it is reported to have amounted to 69,600 tons, valued at $919,000. The principal items of freight transported were lumber, logs, fertilizer, and cotton seed.

It has not been found practicable to ascertain what effect, if any, the improvement has had upon freight rates.

July 1, 1907, balance unexpended	$81.94
July 1, 1908, balance unexpended	81.94

(See Appendix L 10.)

11. Blackwater River, Virginia.—In its original condition this stream afforded a natural channel of 7 feet depth, but navigation was difficult owing to the existence of obstructions and sharp bends.

Between 1878 and 1882 Congress appropriated a total of $14,000 for the improvement of the stream, to consist of the removal of logs, snags, overhanging trees, and the removal of sharp bends. Operations ceased in 1884, from which time no work was done upon the river to 1907.

The existing project was adopted March 2, 1907, and provides for the clearing of the stream of the existing obstructions so as to afford a condition of easy navigation. The estimated cost of the project is $8,000, all of which has been appropriated.

To June 30, 1908, there had been expended $2,144.33 on the existing project, which is completed. The available balance will be expended in maintaining the improvement as may be found necessary from time to time.

On June 30, 1908, vessels drawing 7 feet can navigate the river. The river is a tideless stream, and the only fluctuations in the water level are those due to freshets, which usually do not exceed 3 to 4 feet. The river is navigable from the railroad bridge at Franklin, Va., to its mouth, a distance of about 13 miles.

During the calendar year 1907, the commerce amounted to 5,300 tons, valued at $846,400. The principal items consisted of agricultural products, timber, and fertilizer.

It is impracticable to state what effect, if any, has been made by the improvement upon freight rates.

For more extended information, see Report of the Chief of Engineers for 1875, Part 2, page 161, and report of an examination printed in House Document No. 177, Fifty-ninth Congress, first session.

July 1, 1907, balance unexpended	$8,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	2,144.33
July 1, 1908, balance unexpended	5,855.67

(See Appendix L 11.)

12. Meherrin River, North Carolina.—In its original condition this stream afforded a navigable channel about 80 feet wide and 7 feet deep from its mouth to the town of Murfreesboro, N. C. The channel was tortuous and badly obstructed by logs, overhanging trees, and a few shoals.

In the year 1882 Congress appropriated $5,000 toward the improvement of the river, the improvement to consist in the removal of the obstructions to navigation, and operations were carried on from time to time in the years 1883 to 1886, inclusive. The total expenditure amounted to $4,584.53.

The existing project was adopted by Congress March 2, 1907. It provides for the removal of existing obstructions in the nature of sunken logs, overhanging trees, and a few shoals, so as to render navigation easy. The estimated cost of the project is $6,000, all of which has been appropriated.

To June 30, 1908, there had been expended on the existing project $1,932.88, which is completed. It is proposed to expend the available balance in maintaining the improvement as may be found necessary from time to time.

On June 30, 1908, the maximum draft that could be carried with safety was 7 feet. The river is a tideless stream, but freshets cause variations in the water level of 3 to 4 feet. The head of navigation is at Murfreesboro, 11 miles above the mouth of the river.

During the calendar year 1907 the commerce of the river aggregated 9,321 tons, valued at $1,053,330. The principal items of shipment are timber products and general merchandise.

It is impracticable to state what effect, if any, the improvement has had on freight rates.

For more extended information see Report of the Chief of Engineers for 1882, page 1114, and report of examination printed in House Document No. 137, Fifty-ninth Congress, first session.

July 1, 1907, balance unexpended	$6,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	1,932.88
July 1, 1908, balance unexpended	4,067.12

(See Appendix L 12.)

13. Roanoke River, North Carolina.—Originally the navigable channel to Indian Highland bar, 67 miles above the mouth, was 10 feet deep at mean low water, and thence to the town of Weldon, which is 129 miles from the mouth, the minimum depth was 2½ feet at the same stage.

The project, adopted in 1871, contemplates a channel with a least width of 50 feet from Hamilton to Weldon, 5 feet deep at mean low water, and the removal in the lower portion of the river, below the former point, of such obstructions as may be necessary to accommodate vessels navigating North Carolina sounds. The estimated cost of the work was $269,000.

The expenditures to June 30, 1908, amounted to $238,389.27, of which amount $9,699.04 has been expended in maintenance and $1,351.75 was received from sales. The project is about 80 per cent completed. The channel obstructions have been removed, and a channel depth of 4 feet at mean low water over the projected width has been provided between Hamilton and Weldon. On June 30, 1908, vessels drawing 8½ feet can go as far as Hamilton, and beyond that point, to within a short distance of Weldon, 4 feet can be carried at mean low water. A bar is forming at the mouth of the river, due to deposits brought down by freshets, and this has somewhat diminished the depth that could otherwise be carried to Hamilton. The upper river is subject to heavy freshets, which cause the only variation in the level of the water surface. Weldon, situated about 129 miles from the mouth, is the head of navigation.

The commerce has varied considerably since the improvement was undertaken, the maximum amount of freight transported having been in 1891, when it was 376,181 tons. Since then it has decreased, and for the calendar year 1907 it was reported at 61,108, valued at $3,744,600. The principal item of shipment is timber.

The depletion of the forests and the development of railroads in the territory tributary to the river have served to reduce the volume of water-borne freight in recent years.

It has not been found possible to ascertain what effect, if any, the improvement has had upon freight rates.

The amount estimated as a profitable expenditure for the fiscal year ending June 30, 1910, will be applied in maintaining the improvement by keeping the channel clear of logs, snags, and similar obstructions.

For reference to reports of examinations and surveys, see Report of the Chief of Engineers for 1906, page 249.

July 1, 1907, balance unexpended	$5,667.31
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,704.83
July 1, 1908, balance unexpended	3,962.48
Amount (estimated) required for completion of existing project	40,309.73
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix L 13.)

14. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Wreck of barge* (*name unknown*).—This barge sunk in Smiths Creek, an arm of Norfolk Harbor. Its removal was authorized June 10, 1907. The wreck was removed during the month of July, 1907, at a cost of $300.

(*b*) *Wreck of Edith Fowle.*—This schooner sunk in Norfolk Harbor, Virginia, near the entrance to Smiths Creek. Its removal was authorized August 14, 1907. The wreck was removed during the month of August, 1907, at a cost of $300.

(*c*) *Wreck of Dauntless.*—This schooner sunk in mid-channel, Norfolk Harbor, Virginia. Its removal was authorized September 26,

1907. The wreck was removed during the month of October, 1907, at a cost of $710.50.

(*d*) *Wreck of Emma K.*—This steamer sunk in Chesapeake Bay, Virginia, about 1 mile southeast of Back River light-house. Its removal was authorized December 21, 1907. The wreck was removed during the month of December, 1907, at a cost of $500.

(*e*) *Wreck of Tourist.*—This steamer sunk in Albemarle Sound, North Carolina. Its removal was authorized December 27, 1907. The wreck was removed during the month of February, 1908, at a cost of $1,100.

(*f*) *Wreck of Kate Johnson.*—This schooner sunk in Cypress Creek, Virginia. Its removal was authorized December 28, 1907. The wreck was removed during the month of January, 1908, at a cost of $150.

(*g*) *Wreck of Custis W. Wright and schooner (name not known).*—These schooners sunk in James River, Virginia, near Newport News, Va. Their removal was authorized April 25, 1908. The wrecks were removed during the month of May, 1908, at a cost of $1,154.67.

The total cost of removing these wrecks was $4,215.17.

(See Appendix L 14.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination with plan and estimate of cost of improvement of Pagan River, Virginia.—Reports dated August 1, 1907, and October 18, 1907, respectively, are printed in House Document No. 397, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $4,600 is presented.

2. Preliminary examination and survey of Onancock River, Virginia, between Chesapeake Bay and Onancock.—Reports dated July 5 and December 28, 1907, respectively, are printed in House Document No. 652, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $13,500 is presented.

3. Examination with plan and estimate of cost of improvement of Appomattox River, Virginia (for maintenance).—Reports dated September 25, 1907, and February 5, 1908, are printed in House Document No. 952, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $23,000 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE WILMINGTON, NORTH CAROLINA, DISTRICT.

This district was in the charge of Capt. Earl I. Brown, Corps of Engineers. Division engineer, Lieut. Col. Dan. C. Kingman, Corps of Engineers.

1. Scuppernong River, North Carolina.—From the mouth to Columbia is 5 miles; to Spruill's bridge, 23 miles.

Before work was commenced on the river there was only about 5 feet across the bar at its mouth. The upper portion was obstructed

by logs, snags, stumps, overhanging growth, and abrupt bends, permitting navigation by small vessels only.

The original project, adopted in 1876, was to dredge the bar, make cut-offs at sharp bends, and remove obstructions so as to obtain a channel 60 feet wide and 9 feet deep at low water up to Spruill's bridge.

The present project, adopted by act of June 13, 1902, provides for dredging a channel 3,400 feet long, 150 feet wide, and 9 feet deep at mean low water across the bar at the mouth of the river, at a cost of $14,000.

The project is about 70 per cent completed.

Expended prior to 1902 on previous project		$8,000.00
Expended on present project up to June 30, 1908:		
For improvement	$11,500.00	
For maintenance	3,969.97	
		15,469.97
Total		23,469.97

There was no work done during the fiscal year 1908, the expenditures being for part purchase of plant to be used on this and neighboring works. At the close of the fiscal year 1908, the conditions as far as known, are a channel 9 feet deep at mean low water, 90 feet wide for 2,700 feet of its length, and 130 feet wide for 700 feet of its length across the bar at the mouth of the river; thence to Cross Landing, 14 miles above, a good open channel of 7 feet at mean low water, free from obstacles; thence to Spruill's bridge, 9 miles farther, 7 feet at mean low water, but the river in many places is narrow and crooked and obstructed by overhanging trees on the banks and by logs and snags in the channel.

It is proposed to apply the funds on hand to maintenance, awaiting further appropriations for the completion of the project.

This is a nontidal stream with no slope, the oscillations of the surface being controlled by the winds.

Spruill's bridge, 23 miles from its mouth, is the head of navigation, to which point 7 feet can be carried at mean low water.

The commerce for 1907 amounted to 68,630 tons, valued at approximately $1,660,814, an increase of 23,721 tons over last year. It consisted principally of lumber, timber, cotton, and other farm products.

The effect of the project on freight rates is not known.

References: The adopted project is printed in the Annual Report of the Chief of Engineers for 1901, page 1543.

July 1, 1907, balance unexpended	$2,030.03
June 30, 1908, amount expended during fiscal year for maintenance of improvement	500.00
July 1, 1908, balance unexpended	1,530.03
July 1, 1908, outstanding liabilities	12.60
July 1, 1908, balance available	1,517.43
Amount (estimated) required for completion of existing project	2,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix M 1.)

2. Fishing Creek, North Carolina.—When improvement began the stream was badly obstructed by masses of fallen timber, overhanging trees on banks, logs and snags in channel, and was navigable by rafts only a few miles above the mouth.

The original project of 1889 was to clear the stream of logs, snags, trees, etc., up to Bellamy's mill. It was amended in 1896 to limit the work to that part below the Wilmington and Weldon Railroad bridge, and this amended project was completed in 1901. The sum of $22,715.10 was spent on this project, which has been finished.

Amount expended on present project up to June 30, 1908, for maintenance, $2,187.78.

The proposed application of the available balance of $347.12 is to maintain the natural channel as far as Beech Swamp.

The lower portion of the stream was cleared of obstructions in 1905. It is not navigable above Beech Swamp on account of its tortuous course and rapid current. Below that point it is navigable during the higher stages about eight months annually.

The lower end of the stream is reported by those interested in its navigation to be in poor condition to Beech Swamp, being badly obstructed by fallen trees, logs, and snags. Between Beech Swamp and the railroad bridge the condition of the stream is unknown, but it is presumably bad. The owners of the vessels navigating this stream report that there are so many obstructions that it is unsafe to navigate unless the water is at least 2 feet higher than the stages at which it was safe to navigate just after the stream had been cleared out.

The present head of navigation is Beech Swamp, 17.5 miles from its mouth, to which about 2 feet can be carried during about three months of the year.

The water surface varies from a minimum depth of 6 inches at low water to 10 feet during the high freshet stages.

The commerce for 1907 amounted to 1,491 tons, valued at approximately $25,177, a loss of 760 tons from the previous year; it consisted principally of cotton seed, cotton-seed meal, timber, fertilizers, and peanuts.

The effect of the improvement on railroad and boat rates can not be definitely stated; but the stream when opened to navigation affords an outlet to farm products, timber, lumber, etc., which have no other outlet except by wagons.

References: Annual Reports for 1890, page 1179; 1893, page 1377; 1900, page 1796; 1905, page 1203.

It is proposed to apply the available balance, together with the appropriation recommended, to the maintenance of the natural channel as far as Beech Swamp.

July 1, 1907, balance unexpended	$356.20
June 30, 1908, amount expended during fiscal year for maintenance of improvement	9.08
July 1, 1908, balance unexpended	347.12
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	1,000.00

(See Appendix M 2.)

3. Pamlico and Tar rivers, North Carolina.—(One river, called the Pamlico below Washington, N. C., and the Tar above that point.) Distance from Washington to Greenville, 22 miles; to Tarboro, 49 miles; to Fishing Creek, 56 miles; to Little Falls, 88 miles; to Rocky Mount, 89 miles.

Prior to its improvement, which was begun in 1876, the Pamlico River (that portion of the stream below Washington) was obstructed by war blockades, sunken logs, snags, stumps, and sand shoals.

The governing low-water depths were 5 feet to Washington and perhaps 1 foot to Tarboro, the navigation to which place was practicable during freshet stages only. About 3 feet could be carried to Tarboro during about eight high-water months per year.

The original project for the improvement of the river below Washington was that submitted in December, 1875 (Annual Report of the Chief of Engineers for 1876, p. 361), and adopted by Congress August 14, 1876, and had for its object to provide 9 feet at low water, from Washington to its mouth, by dredging and the removal of piles and obstructions at an estimated cost of $28,050. In the project proper the proposed draft to be provided was not specified, but work under the project was devoted to securing 9 feet at mean low water. Under this project the sum of $18,000 was appropriated, of which $17,877.12 was expended; the remainder, $122.88, was transferred to the improvement of the Pamlico and Tar rivers, when the improvements were combined in 1880.

The Tar River (that portion of the stream above Washington), prior to improvement, was obstructed by sunken logs, piles, wrecks, stumps, snags, and trees in the channel, and overhanging trees along its banks. The original project for this portion of the stream was that of 1879 (Annual Report of the Chief of Engineers for 1879, p. 700) for the removal of obstructions between Washington and Tarboro at an estimated cost of $10,000. An appropriation of $3,000 was made for this purpose in 1879, of which $2,867.27 was expended, leaving a balance of $132.73, which was transferred to the joint improvement.

In 1889 the project was extended to clear the natural channel above Tarboro, 34 miles, to Little Falls, and the estimate was increased $16,200, making the total estimate $92,200.

The present project is that of 1875 (for Pamlico River), and of 1879, 1889, and 1907 (for Tar River), somewhat modified to secure a channel 100 feet wide and 9 feet deep at mean low water to Washington; thence a channel 60 feet wide and 4 feet deep at low water for 22 miles farther, to Greenville; thence a channel 60 feet wide and 20 inches deep at low water for 26 miles farther, to Tarboro; thence to keep clear of obstructions the natural channel 34 miles farther, to Little Falls, 2 miles below Rocky Mount, N. C.

The project as modified by act of March 2, 1907, changed the depth between Washington and Greenville from 3 to 4 feet at mean low water, at an estimated cost of $3,800.

Operations during the year consisted in dredging, by which the project dimensions were obtained and the project completed.

Expended prior to 1876 on previous projects		$10,000.00
Expended on present project up to June 30, 1908:		
For improvement	$149,875.33	
For maintenance	21,818.02	
		171,693.35
Total		181,693.35

The project of 1875, with its various modifications, is completed, there being now a channel to Washington 100 feet wide and 9 feet deep at mean low water; thence to Greenville a channel 60 feet wide and 4 feet deep at low water, and is in good condition except for a small amount of snagging required. Above Greenville the river has deteriorated for lack of maintenance and is navigable only during freshet stages of variable duration, extending over six or eight months of the year.

It is proposed to apply the available balance, together with the appropriation recommended, to maintenance of the improvement, both above and below Washington.

The stream is nontidal. Below Washington the only surface variations of importance are due to the wind, with an extreme range of 3 feet under normal conditions. Long protracted easterly or westerly winds sometimes cause variations of 7 or 8 feet. The variations of the upper portion of the river are affected by freshets only.

The head of navigation is Dunbar's bridge, 108 miles from the mouth.

The commerce for the year 1907 amounted to 428,378 tons, valued at approximately $19,212,294, a decrease since the previous year of 63,006 tons. It consisted principally of cotton, cotton-seed products, grains, potatoes, wood, timber, lumber, fertilizers, machinery, general merchandise, etc.

The tendency of the improvement is to keep down freight rates.

References: History and maps, Annual Reports, 1890, page 1114; 1891, page 1347; 1896, pages 161 and 1101, and 1907, page 267.

July 1, 1907, balance unexpended	$8,441.42
June 30, 1908, refundments during fiscal year	.10
	8,441.52
June 30, 1908, amount expended during fiscal year for works of improvement	6,899.12
July 1, 1908, balance unexpended	1,542.40
July 1, 1908, outstanding liabilities	14.33
July 1, 1908, balance available	1,528.07
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix M 3.)

4. Contentnia Creek, North Carolina.—Distance from the mouth to Snow Hill, 31½ miles; Speights bridge, 50½ miles; Stantonsburg, 63 miles.

Previous to improvement this stream was obstructed throughout its entire length by fallen timber, sand shoals, and overhanging

growth, and was navigable for shallow-draft craft during only the higher freshet stages of about three to six months of the year.

The original project of 1881 was to clear the stream of these obstructions, so as to obtain from its mouth to Stantonsburg, 63 miles, a depth of not less than 3 feet during the higher stages, about nine months of the year, at a cost estimated in 1888 at $77,500.

The project of 1881 as extended in 1894 included maintenance below Snow Hill, and was again extended in 1899 to include maintenance from Stantonsburg to the mouth. The project has been completed, and additional work required is for maintenance.

Amount expended up to June 30, 1908:	
For improvement	$64,394.56
For maintenance	9,068.98
Total	73,463.54

There was no work done during the year. The expenditure was for purchase of plant for use on this and other streams.

At the close of the fiscal year 1907 the creek between its mouth and Snow Hill was in fair condition and could be navigated during six months of the year by boats drawing 3 to 4 feet, depending upon the rainfall. Snow Hill, 31½ miles from its mouth, is practically the head of navigation, although during the higher stages of water boats can ascend the stream to Speights bridge, 50½ miles from its mouth. The portion of the stream between Snow Hill and Speights bridge has been partially resnagged since it was originally cleared of obstructions. The stream is now in need of snagging.

The commerce for the year 1907 amounted to 23,870 tons, valued at approximately $444,390. It consisted principally of cotton, cotton-seed meal, timber, lumber, fertilizer, general merchandise, etc.

The effect of the improvement on railroad and boat rates can not be definitely stated, but the stream when opened to navigation affords an outlet to farm products, timber, lumber, etc., which have no other outlet except by wagon.

References: Annual Reports, 1881, page 1009; 1890, page 1118; 1896, page 1103.

It is proposed to apply the available balance to maintenance of the channel below Snow Hill and the appropriation recommended to further maintenance as required.

July 1, 1907, balance unexpended	$1,944.84
June 30, 1908, amount expended during fiscal year for maintenance of improvement	231.38
July 1, 1908, balance unexpended	1,713.46
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	3,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix M 4.)

5. Neuse and Trent rivers, North Carolina.—(a) Neuse River.—Distance from Newbern to Contentnia Creek, 32 miles; to Kinston, 50 miles; to Whitehall, 74 miles; to Goldsboro (Wilmington and Weldon Railroad bridge), 94 miles; to Smithfield, 150 miles.

There is considerable uncertainty as to the conditions existing prior to 1878, when improvement by the Government was begun. Before the civil war, and probably for some time afterwards, light-draft steamers made more or less regular trips as high up as Smithfield, but the low-water depth probably did not exceed 2 feet, and the stream was obstructed by snags and after the civil war by war blockades. (See Annual Report of the Chief of Engineers for 1905, p. 240.)

The original project of 1871, as extended in 1878–79 and 1880 and continued to date, provides for an 8-foot navigation up to Newbern during the entire year, 4 feet to Kinston, and during nine months of the year 3 feet to Smithfield, by the removal of war obstructions, dredging, jettying, and snagging, at a total estimated cost of $374,000; extended in 1902 to include dredging a channel 300 feet wide below Newbern and 200 feet wide at Newbern, to a depth of 8 feet at dead low water, in accordance with report and estimate printed in Annual Report of the Chief of Engineers for 1905, page 1427, at an estimated additional cost of $59,081.25. Since its adoption this additional estimate has been reduced to $24,000.

In 1902 the improvement of this river was combined with that of Trent.

Amount expended on foregoing projects to June 30, 1908:	
For improvement	$326,758.93
For maintenance	19,386.59
Total	346,145.52

The expenditures for the year were for maintenance, which consisted of snagging between Newbern and Seven Springs whenever the stage of water permitted work to be done, and the opening up of a cut-off formed between two bends near the sixty-fourth milepost.

As a result of the expenditures to date the channel at and below Newbern has been completed to project width and depth, all war blockades have been cleared away, and the natural channel has been cleared to Smithfield, 150 miles above Newbern. No attempt has been made to maintain the stream above Waynesboro Landing (Goldsboro), 98¼ miles above Newbern. At low water 8 feet can be carried to Newbern, 4 feet to Village Creek, 25 miles above, 2.5 feet to the mouth of Contentnia Creek, 31½ miles above Newbern, and 1 foot to Kinston, 50 miles above Newbern, above which point the river is not navigable on stages of less than 2 to 3 feet.

A channel known as the Western channel, immediately above Newbern, has been cleared to a depth of 4 feet at mean low water.

The channel of the river between Newbern and Seven Springs, near Whitehall, is free from all obstructions.

The practical head of navigation is Waynesboro Landing, about 136 miles from the mouth of the river.

The stream is nontidal. The variation of the water surface below Newbern is due entirely to the influences of the wind. The maximum range is 3.3 feet during severe northwest winds to 8½ feet during violent northeast gales. The upper river is subject to freshets, which rise 17 feet at Smithfield, 18 feet at Waynesboro Landing, and 20 feet at Kinston.

The funds on hand are to be used for maintenance and in securing the project depth of 4 feet between Newbern and Kinston by repair-

ing the old jetties and training walls, building new ones where necessary, and supplementing the effect of these structures by dredging.

It is not considered practicable to carry out the project above Newbern as it now stands for any reasonable amount of money, but the appropriation recommended will be applied toward securing 4 feet to the mouth of Contentnia Creek and 2 feet thence to Kinston by dredging where necessary and toward maintenance of the improvement.

The commerce of the year amounted to 448,719 tons, valued at $15,362,992. It consisted of grain, timber, lumber, fertilizers, general merchandise, etc.

Freight rates are materially lessened by reason of the improvement.

References: See Annual Reports of 1879, page 71; 1900, pages 268 and 1802; 1901, page 1545.

July 1, 1907, balance unexpended	$18,192.90
June 30, 1908, amount of sales, rents, etc., received during fiscal year	144.90
	18,337.80
June 30, 1908, amount expended during fiscal year for maintenance of improvement	6,619.32
July 1, 1908, balance unexpended	11,718.48
July 1, 1908, outstanding liabilities	806.91
July 1, 1908, balance available	10,911.57
Amount (estimated) required for completion of existing project	72,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *Trent River.*—Distance from the mouth at Newbern to Polloksville, 18 miles; to lower Quaker bridge, 27 miles; to Trenton, 38 miles. Its original condition was a channel of 6 feet depth to Polloksville, and the stream was fairly clear to lower Quaker bridge, above which point it was badly obstructed.

The original project of 1879 (see Annual Report of the Chief of Engineers for 1879, p. 711) was to secure 3 feet depth at low water to Trenton; extended in 1886 to obtain 8 feet depth through Foys flats; extended in 1889 to clear out obstructions to upper Quaker bridge, 40 miles above Trenton. The sum of $64,262.64 was expended on this project and its modifications.

In 1896 the project of 1879 was amended to provide for the maintenance of a channel only 30 feet wide and 3 feet deep from Newbern to Trenton, at an annual estimated cost of $2,500. This was extended in 1902 to include dredging at Newbern to 8 feet depth at dead low water from harbor line to channel, at an estimated cost of $24,000 additional. The existing project, therefore, is to dredge to 8 feet dead low water at Newbern and maintain a channel 30 feet wide and 3 feet deep at low water to Trenton. In 1902 the improvement

[a] See consolidated money statement on page 289.

of this river was combined with that of the Neuse. This project has been completed.

By joint resolution approved March 4, 1907, authority was given to expend such portion of the appropriation made in river and harbor act of March 2, 1907, as may be necessary for securing a channel 6 feet deep over Foys flats in the Trent River, about 4 miles above Newbern. This work has not yet been done.

Amount expended on existing project up to June 30, 1908:	
For improvement	$23,738.61
For maintenance	15,252.14
Total	38,990.75

The work of the year was for maintenance, and consisted in redredging where shoaling had occurred below Trenton, and snagging where required between Newbern and Trenton. It has been recently reported that a freshet has caused the shoals below Trenton to form again, and that more snagging is needed.

The improvement above Trenton has been abandoned.

Between Trenton and Newbern a 3-foot channel exists and the stream is in good condition. The maximum draft that can be carried June 30, 1908, to Trenton, 38 miles above the mouth, which is the head of navigation, is 3 feet.

Near the mouth the water level varies about 3 feet under normal conditions, according to the prevailing winds. Long protracted easterly or westerly winds sometimes cause a variation of 7 or 8 feet. At Trenton the stream is subject to freshets of about 5 to 15 feet during the winter months.

The commerce during 1907 amounted to 268,376 tons, valued at $12,065,478. It consisted principally of lumber, general merchandise, fertilizers, cotton, and other farm products.

The effect of this improvement on freight rates is not known.

References: Annual Reports, 1879, page 711; 1900, pages 268 and 1802; 1901, page 1545.

The available balance will be applied to completion of the additional work authorized by resolution of March 4, 1907, and the appropriation asked for will be applied to maintenance of the improvement.

July 1, 1907, balance unexpended	$12,115.85
June 30, 1908, amount received in refundment during fiscal year	13.10
	12,128.95
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,520.34
July 1, 1908, balance unexpended	8,608.61
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

a See consolidated money statement on page 289.

CONSOLIDATED.

July 1, 1907, balance unexpended	$30,308.75
June 30, 1908, amount received from sales, rent, and refundment during fiscal year	158.00
	30,466.75
June 30, 1908, amount expended during fiscal year for maintenance of improvement	10,139.66
July 1, 1908, balance unexpended	20,327.09
July 1, 1908, outstanding liabilities	806.91
July 1, 1908, balance available	19,520.18
Amount (estimated) required for completion of existing project	72,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	35,000.00

(See Appendix M 5.)

6. *Inland waterway from Pamlico Sound to Beaufort Inlet, North Carolina.*—Distance from the 10-foot mean low-water contour in Adams Creek (a tributary of the Neuse River) to the head of Adams Creek is about 4 miles; from the head of Adams Creek across the country to the head of Core Creek is about 4 miles; from the head of Core Creek to the mouth of Core Creek is about 4 miles; and the distance from the mouth of Core Creek to the 10-foot depth at mean low water in the Newport River is about 3 miles; making the total distance over which dredging will be required about 15 miles.

At the time of the adoption of the existing project a low-water depth of about 5 feet could be carried from the 10-foot contour in Adams Creek to near its head; from the head of Adams Creek to the head of Core Creek is across dry land; from the head of Core Creek to its mouth the creek is practically bare at low water, and from the mouth of Core Creek to the 10-foot contour in Newport River the low-water depth will average about 6 feet.

The present and only project, adopted by act of Congress approved March 2, 1907, contemplates securing, by dredging, a channel 10 feet deep at low water from Pamlico Sound to Beaufort Inlet via Adams and Core creeks, said channel to have a minimum bottom width of 90 feet through dry land with side slopes of 1 to 2½ and minimum bottom width of 125 feet with side slopes of 1 to 3 through the creek and river portions, at an estimated cost of $550,000.

Amount expended on project for improvement to June 30, 1908, $11,746.90.

The work of the year consisted of surveying to definitely locate the route for the proposed waterway, surveying tracts of land required for right of way, preparing abstracts and examining titles of same, and preparation of specifications for advertising work.

The work was advertised on June 25, and proposals are to be opened July 27, 1908.

The river and harbor act of March 2, 1907, authorized continuing contracts for completing the project in the sum of $350,000, of which $180,000 is yet to be appropriated.

The appropriation recommended will be applied toward completion of the project for extension of benefits.

References: Pages 1393 and 1394, Report of the Chief of Engineers for 1904, and House Document No. 84, Fifty-ninth Congress, second session.

July 1, 1907, balance unexpended	$199,075.09
Amount refunded during fiscal year	.08
Amount appropriated by sundry civil act approved May 27, 1908	170,000.00
	369,075.17
June 30, 1908, amount expended during fiscal year for works of improvement	10,821.99
July 1, 1908, balance unexpended	358,253.18
July 1, 1908, outstanding liabilities	93.68
July 1, 1908, balance available	358,159.50
Amount (estimated) required for completion of existing project	180,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	180,000.00

(See Appendix M 6.)

7. Waterway between Newbern and Beaufort, N. C. (via Neuse River, Clubfoot Creek, Clubfoot and Harlowe Canal (private), Harlowe Creek, and Newport River).—Distances: Newbern to Clubfoot Creek, 20 miles; thence to Clubfoot and Harlowe Canal, 6 miles; thence to Harlowe Creek, 3.2 miles; thence to Newport River, 3¼ miles; thence to Beaufort, 7 miles.

The first appropriation for this work was made by the river and harbor act of 1882, which provided that $5,000 from the appropriation for Neuse River and a like sum from the appropriation for Beaufort Harbor should be "applied to the improvement of the line of inland navigation from Newbern to Beaufort Harbor."

No estimate or project for said improvement had at that time been made, but in October, 1883 (Annual Report of the Chief of Engineers for 1884, p. 1067), an estimate was prepared which contemplated a channel 80 feet wide and 9 feet deep, at an estimated cost of $883,580, exclusive of the cost of a tide lock and of the canal company's franchise and property.

The available funds being totally inadequate for this improvement, the project adopted in 1884 for the expenditure of said funds contemplated a channel 30 feet wide and 5 feet deep at mean low water, the estimated cost being $92,000.

This project of 1884 constitutes the existing project.

All work of improvement has been confined to the natural channels in Clubfoot and Harlowe creeks and Newport River.

Amount expended on existing project to June 30, 1908:	
For improvement	$29,739.84
For maintenance	6,537.77
Total	36,277.61

The expenditures for the year were for clearing obstructions from the channels of Clubfoot and Harlowe creeks, and for the part purchase of plant for use in this and other improvements.

The governing depth in Harlowe Creek was increased several years ago to the project depth of 5 feet, but for lack of maintenance had decreased to about 1 foot in 1905. During the fiscal year 1907 the shoal at the mouth of the creek was redredged to the project depth, but another shoal of less consequence was left inside the creek. The channel in Clubfoot Creek had never been dredged until the fiscal year 1906. Some snagging, etc., had been done in both creeks, but no work in the canal connecting the two creeks has ever been done by the Government, since said canal is owned by a corporation.

The dredged cut at the mouth of Harlowe Creek has deteriorated considerably since its completion, but on account of the dredging done in Clubfoot Creek during the fiscal year 1906 and in 1907 those portions of the waterway under improvement are, on the whole, in better condition now than ever before, although there are many complaints of logs, etc., obstructing the private canal.

The controlling depth at mean low water is now from 2 to 2½ feet, the shoalest place being near the mouth of Harlowe Creek; but at high water about 4 feet can be carried, shoalest water being in the canal.

It is proposed to apply the available balance to maintenance.

An additional appropriation of $1,000 is recommended for the maintenance of this waterway until the inland waterway, Pamlico Sound to Beaufort Inlet, is completed, after which the present route via Clubfoot and Harlowe Canal will not be required.

The commerce for the year ending December 31, 1907, amounted to 28,530 tons, valued at approximately $1,748,755, and consisted principally of cotton, cotton seed, fish, oysters, clams, timber, lumber, fertilizers, and general merchandise.

References: Annual Reports, 1884, page 106; 1890, page 1130, and 1896, page 113.

July 1, 1907, balance unexpended	$2,031.60
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,309.21
July 1, 1908, balance unexpended	722.39
Amount (estimated) required for completion of existing project	55,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	1,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix M 7.)

8. Harbor at Beaufort, N. C.—When improvement (begun in 1836) was resumed in 1881, the erosion at Fort Macon and Shackelford points was causing serious deterioration of the inside channels and threatening deterioration of the bar channel. The governing low-water depth is said to have been 15 feet on the bar and 2 feet at Beaufort, N. C.

The original project is that of 1881, to stop erosion at the inlet (Fort Macon and Shackelford points) by jetties and to provide a channel 200 feet wide and 9 feet deep at ordinary low tide to Beaufort, and a channel 100 feet wide and 6 feet deep from Beaufort to the 6-foot contour of the channel leading up North River, estimated to cost $82,103.38, increased in 1885 to $159,000, when the project was modified by reducing the channel to Beaufort to 100 feet and its depth to 5 feet at mean low water and eliminating the channel east from Beaufort. In 1887 the estimate for the above work was further increased to $163,000.

The project was again modified in 1890, the project depth of the bulkhead channel being increased to 7 feet. The project as modified was completed.

The amount expended under the original project as modified was $148,843. To the above amount should be added $5,000, appropriated July 4, 1836, making the total cost up to the completion of the original project $153,843.

The existing project of 1896 includes the maintenance of jetties and sand fences at Fort Macon and Shackelford points and the maintenance of the 7-foot channel across Bulkhead Shoal and thence to the wharves at Beaufort. The object of the jetties and sand fences is to protect the land on the opposite sides of the inlet, thus preventing the inlet from shifting and deteriorating. The river and harbor act of March 2, 1907, authorized a sufficient amount of the appropriation made therein to be applied to repairing existing jetties at Fort Macon Point and constructing additional jetties and shore protection.

The amount expended on present project for maintenance to June 30, 1908, was $20,449.53.

The expenditures of the year were for the part removal of the remains of the inner or western spur jetty at Fort Macon Point, which was flanked in December, 1906, and the completion of four other jetties at Fort Macon Point with stone removed from the old jetty; the repair of sand fences at Fort Macon Point, repair of plant preliminary to resuming work of maintenance, and making a survey of the harbor.

It is proposed to expend the available balance and the appropriation recommended in redredging channels in front of Beaufort and across Bulkhead Shoal, maintaining said fences at Fort Macon and Shackelford points, and possibly in repairing and building rock jetties at Fort Macon and Shackelford points.

A draft of 4½ feet can now be carried across Bulkhead Shoal, and 7 feet can be carried from there to the wharves at Beaufort at mean low water.

The tide rises 2 feet at Beaufort and 3 feet at the inlet.

The commerce for the year 1907 amounted to 49,261 tons, valued at approximately $2,421,556.50.

The maintenance of this channel tends to prevent the rise in freight rates by allowing the larger vessels to reach the wharves at Beaufort.

References: Annual Reports, 1881, page 1013; 1893, page 1457; 1896, page 1115; 1899, page 1498.

July 1, 1907, balance unexpended	$21,256.81
June 30, 1908, amount expended during fiscal year for maintenance of improvement	7,199.34
July 1, 1908, balance unexpended	14,057.47
July 1, 1908, outstanding liabilities	1,007.38
July 1, 1908, balance available	13,050.09
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix M 8.)

9. Beaufort Inlet, North Carolina.—When improvement began in September, 1905, there was a minimum depth on the bar of approximately 12 feet at mean low water.

The original project, which is also the existing project, is printed on page 1415 of the Annual Report of the Chief of Engineers for 1904 and was adopted by Congress in 1905. It contemplates a channel 300 feet wide, 20 feet deep at mean low water, across the bar, to be obtained by dredging, at an estimated cost of $45,000.

Amount expended on existing project to June 30, 1908:	
For improvement	$44,484.24
For maintenance	312.69
Total	44,796.93

The work to date has consisted of the necessary surveys, etc., and the dredging of 426,630 cubic yards of material from the bar channel in 1906 and 1907. The result of this work was an increase of the minimum depth on the bar from 10.8 feet at mean low water when work began to about 20 feet on June 30, 1907, the minimum width of the 20-foot channel being about 200 feet. This channel has deteriorated during the past year, due to lack of funds for maintenance, the minimum mean low-water depth on June 30, 1908, being only 16.5 feet.

About 65 per cent of the project is completed.

There was no work done during this fiscal year.

It is proposed to apply the available balance and the appropriation recommended to the work of maintenance.

During the past year shoaling has amounted to about 100,000 cubic yards, the cost of removal of which will be about $10,000.

The commerce for the calendar year 1907 amounted to 15,869 tons, valued at $427,540.

The effect of this improvement will be to lessen freight rates by affording water transportation for products which have hitherto been dependent entirely upon railroads.

This work is designed to provide a deep-water outlet to the ocean for the inland waterway, Pamlico Sound to Beaufort Inlet, North Carolina.

References: Annual Reports, 1881, page 1009; 1890, page 1118; 1896, page 1103.

July 1, 1907, balance unexpended	$5,515.76
June 30, 1908, amount expended during fiscal year for maintenance of improvement	312.69
July 1, 1908, balance unexpended	5,203.07
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	15,000.00

(See Appendix M 9.)

10. New River, North Carolina, including inland waterways between Beaufort Harbor and New River and between New River and Swansboro.—The act of March 2, 1907, combined these three improvements under this new heading.

(*a*) *New River.*—Appropriations amounting to $50,000 were made for the river in 1836, 1837, and 1838, after which no further appropriations were made until 1882, when $5,000 was appropriated. Another appropriation of $5,000 was made in 1884; but since these amounts were considered too small to justify undertaking the improvements, no work was done until 1886, when still another appropriation, of $10,000, was made.

When improvement began in 1886, the governing low-water depth was 4 feet for a distance of 23 miles to Jacksonville, and the channel included two circuitous parts around Wrights Island and Cedar Bush Marsh.

The original project of 1886 was to dredge a cut 4 feet deep and 100 feet wide through Wrights Island and a second cut 4 feet deep and 150 feet wide through Cedar Bush Marsh. Both were completed, but the Cedar Bush Marsh cut deteriorated at the upper end and was abandoned, and the project of June 18, 1894, to obtain 4 feet depth around Cedar Bush Marsh by dredging and an experimental timber training wall was adopted and successfully carried out. The additional work required is for maintenance.

The act of March 3, 1905, authorized the balance from the project of 1894 to be expended in rebuilding the dike hitherto constructed. This was done, and the dike is now permanent.

Amount expended since civil war on previous projects	$20,442.35
Amount expended on present project of 1894 (as amended to date) up to June 30, 1908:	
For improvement	9,186.39
For maintenance (including rebuilding dike)	3,407.81
Total	33,036.55

The expenditures during the year were for office expenses.

It is proposed to apply the existing balance and the appropriation recommended to maintenance.

The project depth of 4 feet has twice been obtained and twice lost through lack of maintenance. The project depth now exists, although the channel is quite narrow near the head of the marshes. The tidal range at the inlet is about 3½ feet and at the head of the marshes about 1 foot. The head of navigation for all practical purposes is Tar Landing, 3 miles above Jacksonville and 26 miles from the mouth of the river, to which a present depth of 4 feet can be carried. The

depth on the bar at the mouth of the river is now 4 feet, but varies from time to time.

The commerce for 1907 amounted to 24,803 tons, valued at approximately $477,278. It consisted principally of timber, fish, cotton, cotton seed, and general merchandise.

In its present condition this stream probably has very little effect on freight rates in general, but it affords transportation for products which would otherwise have no means of transportation except by wagon. If the bar and channel were sufficiently improved to justify a line of steam vessels between Wilmington and Jacksonville, freight could probably be carried to the latter point much more cheaply than at present.

References: Annual Reports, 1882, page 1117; 1886, page 992; 1891, page 1380; 1899, page 1501, and 1907, page 277.

July 1, 1907, balance unexpended	$1,998.05
June 30, 1908, amount expended during fiscal year for maintenance of improvement	34.50
July 1, 1908, balance unexpended	1,963.55
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *Waterway between New River and Swansboro, N. C.*—This waterway is a part of the waterway between Beaufort Harbor and New River (see pp. 1124–1127, Annual Report of the Chief of Engineers for 1889), but in 1890 two separate appropriations were made—one for the "Inland waterway between Beaufort Harbor and New River" and the other for the "Waterway between New River and Swansboro," and hence separate reports are made for the two improvements, although one embraces the other.

This waterway is about 22 miles long and originally consisted of tortuous tidal channels winding through the marine marsh, which extends from Swansboro to New River, between the mainland on the one side and the barrier beach or "banks" (which separates it from the ocean) on the other. In the vicinity of the four inlets communicating with the ocean the width of the waterway was several hundred feet and its depth from 12 to 15 feet, while between them its width diminished to about 12 feet in places and its depth to 6 inches at ordinary low water.

The original and existing project, adopted in 1889, is to enlarge the waterway by dredging to a minimum width of 40 feet and minimum depth of 3 to 4 feet at mean high water, at an estimated total cost of $43,000.

Until June 13, 1906, no work except a survey made in April and May, 1901, had ever been done on this waterway, for the reason that an act of the general assembly of North Carolina, ratified February 13, 1889, had incorporated the Wrightsville and Onslow Navigation Company with the exclusive right to navigate said waterway, as set forth in House Executive Document No. 26, Fifty-second Congress,

[a] See consolidated money statement on page 298.

first session (p. 1147 of the Annual Report of the Chief of Engineers for 1892).

On February 6, 1905, however, a paper was obtained from the two survivors of the four parties named in the charter of said Wrightsville and Onslow Navigation Company, in which paper it was declared that the privileges and franchises granted in said charter had never been exercised and that said privileges and franchises had "to all intents and purposes been surrendered and abandoned."

All obstacles in the way of Government improvement having been thus removed, work was begun as soon as plant for the purpose could be spared from other more pressing work.

Amount expended on existing project up to June 30, 1908:

For improvement	$17,172.86
For maintenance	500.00
Total	17,672.86

The expenditures for the year were $12,672.86, of which amount $12,172.86 was for improvement, by dredging, at the "Opening," "Standback," and Sand shoal, extending the 3.5 feet mean high-water depth westward to New River; and the remaining $500 was for maintenance of dredged cuts at "Standback" and Sand shoals, dredged during fiscal years 1906–7.

At present the project depth exists through the entire waterway, and the project width exists from the eastern end of Sand shoal, 16 miles from Swansboro, to New River; but there are several places between Swansboro and Sand shoal where the project width does not exist. About 75 per cent of the project is completed.

It is proposed to apply the available balance and the additional appropriation recommended to the maintenance of the present dredged cuts and in obtaining the project width between Swansboro and Sand shoal.

The rise and fall of the tide varies from 2.2 to 4 feet in the neighborhood of the inlets to about 1 foot at the points most distant from the inlets.

The commerce of 1907 amounted to 5,644 tons, at an approximate value of $299,887. It consisted principally of cotton, fish, oysters, clams, and fertilizers. This can not be taken as an indication of the amount of commerce that will utilize the waterway now that the proposed improvement has been made, for the difficulty and delay incident to navigation were formerly so great that commerce naturally sought other routes.

The improvement of this waterway will probably have no direct effect upon freight rates, but it will afford means of transportation for large quantities of timber, lumber, and miscellaneous products that now have no outlet except by wagon or by the smallest draft boats.

References: For description of this waterway see Annual Reports for 1892, page 1146, and 1893, pages 1399 and 1400.

July 1, 1907, balance unexpended		$12,000.00
June 30, 1908, amount of rents and refundments received during fiscal year		875.00
		12,875.00
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$12,172.86	
For maintenance of improvement	500.00	
		12,672.86
July 1, 1908, balance unexpended		202.14
July 1, 1908, outstanding liabilities		54.93
July 1, 1908, balance available		147.21
Amount (estimated) required for completion of existing project		26,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

(c) *Waterway between Beaufort Harbor and New River (i. e., portion between Beaufort and Swansboro).*—Distance from Beaufort to Swansboro, 30 miles, with access at Swansboro to the Atlantic Ocean through Bogue Inlet.

When improvement began in 1886, the governing low-water depth was 18 inches to Swansboro.

The original project is that of 1885, to provide a channel 100 feet wide and 3 feet deep at ordinary low water between Beaufort Harbor and Swansboro, estimated to cost $6,000. This estimate was increased in 1887 to $50,000 and again increased in 1892 to $71,040.

No project was adopted originally for the part beyond Swansboro, but in 1889 a separate project for a channel 40 feet wide by 3 or 4 feet deep over this portion of the waterway was adopted, the estimated cost being $43,000. The act of 1890 made a separate appropriation of $5,000 for this portion of the route, designating it as the "Waterway between New River and Swansboro." (See pp. 1376–1378, Annual Report of the Chief of Engineers for 1891.)

The project is about 85 per cent completed.

The amount expended on present project to June 30, 1908, for improvement, is $51,832.36.

No work was done during the fiscal year, the expenditures being for part purchase of plant and collecting commercial statistics.

At the close of the fiscal year 1907 the project depth of 3 feet prevailed throughout the entire length of 30 miles between Beaufort Harbor and Swansboro, the dredged channel being 100 feet wide (project width) through one shoal 980 feet long, 60 feet wide through six shoals aggregating 24,696 feet in length, and 40 feet wide through another shoal 874 feet long.

It is reported that no shoaling of any consequence has taken place in the past year, and hence the above conditions may be taken as the conditions prevailing June 30, 1908.

The tide at Beaufort Inlet at the eastern end of this waterway and at Bogue Inlet (the western end of the portion improved under appropriations for waterway between Beaufort Harbor and New

[a] See consolidated money statement on page 298.

River) has a range of about 3½ feet. Where the tides meet in Bogue Sound the range is only about 1 foot.

The commerce during the calendar year 1907 amounted to 29,174 tons, valued at $1,156,164. The commerce consisted chiefly of lumber, shingles, etc., fish, oysters and clams, rosin and turpentine, miscellaneous farm products, fertilizers, and general merchandise.

It is proposed to use the balance of funds remaining unexpended and the appropriation recommended in maintenance and in increasing the width of the dredged cuts to the project width of 100 feet.

References: Annual Report, 1885, page 1133; 1891, page 1378; 1892, page 1141; 1893, page 1397; 1894, page 1034; 1896, page 1117; 1897, page 1398.

July 1, 1907, balance unexpended	$5,017.64
June 30, 1908, amount expended during fiscal year, for maintenance of improvement	850.00
July 1, 1908, balance unexpended	4,167.64
Amount (estimated) required for completion of existing project	16,040.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

CONSOLIDATED.

July 1, 1907, balance unexpended		$19,015.69
June 30, 1908, amount of rent and refundments received during fiscal year		875.00
		19,890.69
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$12,172.86	
For maintenance of improvement	1,384.50	
		13,557.36
July 1, 1908, balance unexpended		6,333.33
July 1, 1908, outstanding liabilities		54.93
July 1, 1908, balance available		6,278.40
Amount (estimated) required for completion of existing project		42,040.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		30,000.00

(See Appendix M 10.)

11. Northeast and Black rivers, and Cape Fear River above Wilmington, N. C.—(*a*) *Northeast River.*—Distance from mouth to Bannerman's bridge, 48 miles; to Hallsville, 88 miles; to Kornegay's bridge, the head of navigation, 103 miles.

The original condition when improvement began was a channel badly obstructed by logs, snags, and overhanging trees. The river was navigable to Bannerman's bridge, with governing low-water depth of 6 feet.

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[a] See consolidated money statement on this page.

The original project of 1889 is still in force and includes the clearing of the natural channel for small steamers to Hallsville and for pole boats to Kornegay's bridge at an estimated cost of $30,000. Additional work proposed is for maintenance only. Work on the project is 60 per cent completed.

Amount expended on present project up to June 30, 1908:	
For improvement	$10,687.96
For maintenance	10,031.75
Total	20,719.71

There was no work done during the year.

As the result of the expenditures to date the channel has been kept cleared, except when funds were too low and when it has been impracticable on account of low water or for other causes for the plant to work. Six feet of water can be carried to Bannerman's bridge and 3 feet to Croom's bridge during all stages of the water.

From Croom's bridge to Kornegay's bridge, the head of navigation, the river is so shallow that navigation is practicable only when the water is up. This is liable to occur at any time, but during the summer low stages usually prevail.

There is a tidal range of about 2 feet at the mouth of this stream, which decreases to nothing at or a short distance above Bannerman's bridge. The upper portion is subject to freshets of from 8 to 12 feet.

The channel is at present badly obstructed by snags, etc., above the sixty-eighth milepost and is partially obstructed below that point.

The commerce for 1907 amounted to 106,604 tons, estimated at approximately $1,605,565. It consisted principally of timber, naval stores, fertilizers, general merchandise, cotton, and miscellaneous farm products.

The commerce is handled on a few boats that make some attempt at regular trips and on a large number of rafts, flats, etc. Hence it is impossible to estimate the commerce with much accuracy.

References: Annual Reports, 1885, page 1123; 1890, page 1181; 1895, page 1389; 1896, page 1122, and 1907, page 282.

A present draft of 6 feet can be carried 48 miles to Bannerman's bridge, and 3 feet to Croom's bridge, 8 miles above, at lowest stages; from Croom's bridge, 47 miles to Kornegay's bridge, the stream is navigable only for small boats and rafts for about eight months during the year.

The minimum low-water depth to Bannerman's bridge is 6 feet; to Croom's bridge, 3 feet; to Hallsville, 0.5 foot; to Kornegay's bridge (the head of navigation), 0.1 foot.

With the available balance it is proposed to maintain the natural channel to Hallsville.

The additional appropriation recommended is for maintenance.

July 1, 1907, balance unexpended	$3,023.62
July 1, 1908, balance unexpended	3,023.62
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

a See consolidated money statement on page 302.

(*b*) *Black River.*—The original condition when improvement began was a natural channel cleared fairly to Point Caswell and roughly to Lisbon, with governing low-water depths of 4 feet to Point Caswell, 2.5 feet to Haws Narrows, and 1.5 feet to Lisbon.

The original project of 1885 included clearing the natural channel and banks to Lisbon and the cutting off of a few sharp points at bends. It was amended in May, 1893, by omitting that part of the river above Clear Run, and, as amended, was completed September 20, 1895.

The existing project of 1894 is to maintain the natural channel to Clear Run, at an estimated cost of $2,000 per annum.

Amount expended to June 30, 1908:	
On previous project mentioned above	$12,358.40
On present project, for maintenance	9,206.17
Total	21,564.57

There was no work done during the year.

The result obtained by the expenditures to date has been a cleared channel whenever funds were available, permitting navigation to Point Caswell, 24 miles above the mouth, at all stages, and to Clear Run, 66 miles above the mouth, at stages of 1.5 feet or higher above low water, the governing low-water depths at present being 5 feet to Point Caswell, 2.5 feet to Haws Narrows, 32 miles above the mouth, and 1.5 feet to Clear Run. There is no steamboat navigation above Clear Run. Lisbon, 74 miles from the mouth, is the head of navigation. The low-water stages prevail usually from May to August, inclusive; during the rest of the year the stage is about 5 to 8 feet higher, but the periods of high and low water are by no means the same every year. No further work, excepting maintenance, is now proposed.

A number of obstructions are reported.

It is proposed to expend the available balance for maintenance of the natural channel up as far as Clear Run, and the appropriation recommended is for further maintenance as required.

The commerce during 1907 amounted to 47,205 tons; estimated value, $1,026,294. It consisted principally of timber, general merchandise, naval stores, fertilizers, cotton, and other farm products. The commerce is handled on a few boats, which make some attempt at regularity, and on a large number of rafts, flats, etc., whose trips are altogether irregular. Hence it is impossible to get the commercial statistics with even fair accuracy.

References: For history, see Annual Report for 1896, page 1125 For report on examination, see Annual Report for 1907, page 281.

July 1, 1907, balance unexpended	$3,178.77
July 1, 1908, balance unexpended	3,178.77
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*c*) *Cape Fear River above Wilmington, N. C.*—The original condition when work began was a channel badly obstructed above Kellys

[a] See consolidated money statement on page 302.

Cove by logs, snags, etc., and with governing low-water depths of 4 feet to Kellys Cove and 1 foot to Fayetteville.

The original project of January 26, 1881, was to clear the river to Fayetteville and obtain a continuous channel by jettying and dredging, estimated in July, 1893, to cost $275,000 for a channel 4 feet deep to Elizabethtown, and 3 feet deep to Fayetteville. It is about 30 per cent completed.

The existing project, adopted by act of June 13, 1902, is to obtain, by canalizing, a low-water depth of 8 feet to Fayetteville, at an estimated cost of $1,350,000.

In consequence of this new project the former project has been abandoned, excepting for the maintenance of the natural channel, pending the construction of locks and dams.

Amount expended on project of 1881 to June 30, 1908:	
For improvement	$134,436.96
For maintenance	16,855.81
Total	151,292.77
Amount expended on project of 1902 to June 30, 1908:	
For improvement	14,473.89
Total	165,766.66

There was no work done during the year. The money expended was for inspection, part purchase of office supplies, and for expenses incurred in collecting commercial statistics.

The additional appropriation asked for will be devoted to continuing the work of maintenance by open-channel work.

At present the low-water depths are 8 feet to Kings Bluff, 38 miles above Wilmington; 2½ feet to Elizabethtown, 73 miles above Wilmington, and 2 feet to Fayetteville, 115 miles above Wilmington. Fayetteville is the head of navigation. Low-water stages prevail from two to four months during each summer, and freshets, which raise the water level from 15 to 50 feet at Fayetteville (the effects lower down being less marked), usually occur as often as once a month during the rest of the year. They do not occur with any regularity, however.

The commerce for 1907 was estimated at 139,059 tons, estimated to be worth $4,040,217.

Locks and dams.—The act of June 13, 1902, appropriated $50,000 for the purchase of sites for locks and dams. A careful survey, consuming more than eleven months' time, was made for the purpose of locating the sites. This survey has been completed, the sites tentatively located, a number of borings made at each site, the locations approved, and prices obtained on all the lands necessary.

Abstracts of the titles have been made and turned over to the United States district attorney for examination. The titles to the land needed at lower site have been approved, and the land purchased.

Owing to the fact that Congress has directed a reexamination of this river, with a view to a possible modification of the project, the purchase of the other land has been delayed, as its purchase may not be required.

No estimate is submitted for further work on the existing project for locks and dams, pending action by Congress on the modified plan for this improvement contained in House Document No. 890, Sixtieth Congress, first session, which is based on the reexamination authorized by the river and harbor act of March 2, 1907.

The expenditures to June 30, 1908, on said project for surveys, other preliminaries, and purchasing land at lower site, amounted to $14,473.89.

The expenditures for the year were for inspection and office expenses.

References: Annual Reports for 1872, page 742; 1881, page 1018; 1901, page 1559, and 1904, page 1493.

July 1, 1907, balance unexpended	$7,520.89
June 30, 1908, amount expended during fiscal year for maintenance of improvement	149.33
July 1, 1908, balance unexpended	7,371.56
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

CONSOLIDATED.

July 1, 1907, balance unexpended	[b] $13,723.28
June 30, 1908, amount expended during fiscal year for maintenance of improvement	149.33
July 1, 1908, balance unexpended	13,573.95
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	12,000.00

CAPE FEAR RIVER ABOVE WILMINGTON, N. C., LOCKS AND DAMS.

July 1, 1907, balance unexpended	$35,899.17
June 30, 1908, amount expended during fiscal year for works of improvement	373.06
July 1, 1908, balance unexpended	35,526.11
Amount (estimated) required for completion of existing project	1,300,000.00

(See Appendix M 11.)

12. Cape Fear River, North Carolina, at and below Wilmington.—The condition of the river prior to the opening of New Inlet (which seems to have occurred during an equinoctial storm in 1761) is rather uncertain, but old maps indicate that there was a low-water depth of 14 feet across the bar at the mouth, the least depth between Wilmington and the mouth being 7.5 feet. There is also some uncertainty as to the conditions in 1829, when the improvement was first undertaken by the United States, but the most reliable information is that there was then about 7 to 7.5 feet at low water in the river, about 9 feet in Baldhead channel, 9 feet in the Rip channel, and 10 feet at New Inlet. Work on the bar was first begun in 1853, at which time the bar depths at low water were 7.5 feet in Baldhead channel, 7 feet in Rip channel, and 8 feet at New Inlet, the governing low-water depths in the river having been increased to 9 feet.

The original project of 1827 was to deepen by jetties the channel through the shoals in the 8 miles next below Wilmington. This project resulted in a gain of 2 feet available depth. The project of 1853 was to straighten and deepen the bar channel by dredging, jetty-

[a] See consolidated money statement on this page.
[b] Erroneously stated as $13,723.58 in printed report for 1907.

ing, diverting flow from the New Inlet, and closing breaches in Zekes Island. This project was incomplete when the civil war began.

After the civil war the first project was that of 1870, to deepen the bar channel by closing breaches between Smiths and Zekes islands, with the ultimate closure of New Inlet in view. The project of 1873 included that of 1870, and in addition the dredging of the bar channel and closing of New Inlet. The project of 1874 was to obtain by dredging a channel 100 feet wide and 12 feet deep at low water up to Wilmington. The project of 1881 was to obtain by dredging a channel 270 feet wide and 16 feet deep at low water up to Wilmington. These projects had been practically completed in 1889.

The project adopted September 19, 1890 (see Annual Report of the Chief of Engineers for 1889, p. 1132), is to obtain a mean low-water depth of 20 feet and a width of 270 feet from Wilmington to the ocean, at an estimated cost of $1,800,000. This project was modified by act of June 13, 1902, to authorize the construction of mooring dolphins at Wilmington at a cost of $30,000, and to provide for the removal of obstructions at mouth of Brunswick River, at an estimated cost of $1,000. The project was modified by the river and harbor act of March 2, 1907, which provides for continuing improvement in accordance with report submitted in House Document No. 545, Fifty-ninth Congress, first session, for completion of the 20-foot project to the projected width, by dredging and the excavation of a mooring basin in lieu of constructing mooring dolphins at Wilmington, involving a reduction in the estimate of cost to $1,392,750, including removal of obstructions at mouth of Brunswick River. The act also authorized improvement to such depth in excess of 20 feet as appropriations for the work may permit, due regard being given to the difference in tidal oscillation at the upper and lower portions of the improvement, and authorizes so much as may be necessary of the funds available to be applied to repairing the New Inlet and Swash Defense dams. The cost of these repairs is estimated at $165,000. Annual maintenance is estimated to cost $65,000.

The river and harbor act of March 2, 1907, appropriated the sum of $165,000 for improvement, and authorized an additional expenditure of $250,000, of which $100,000 is yet to be appropriated.

No contracts for improvement have yet been made.

EXPENDITURES.

Prior to civil war (including balance transferred)		$363,228.92
Since civil war on prior projects		2,102,271.93
On existing project to June 30, 1908:		
For improvement	$1,227,932.98	
For maintenance	387,729.45	
		1,615,662.43
Total		4,081,163.28

On September 17, 1906, a storm of extreme violence very materially injured Swash Defense and New Inlet dams throughout their entire length and wholly destroyed Swash Defense dam in several places.

The total results obtained on the project up to the end of the fiscal year may be summarized as follows:

At the ocean bar a 20-foot mean low-water channel exists from deep water outside to deep water inside, the width being 300 feet.

From the ocean bar to Keg Island, 20 miles above, there is a 20-foot mean low-water channel, with a least width of 259 feet, and in addi-

tion the channel at old Brunswick Cove shoal has been dug to a depth of 22 feet for a width of 74 feet, and a channel of the same width and depth has been dug through a portion of Lilliput shoal.

From Keg Island to Wilmington, 30 miles from the ocean, there is a 20-foot mean low-water channel with a minimum width of 259 feet, and a 22 to 24 foot mean low-water channel, with a least width of 148 feet.

The average rise of the tides is 4½ feet at the ocean bar, 3½ feet at Keg Island, and 2½ feet at Wilmington.

The distance from the ocean bar to Wilmington is 30 miles, and the river is navigable 115 miles farther up to Fayetteville, the head of navigation.

The additional work proposed with funds on hand and the additional sum requested is toward the prosecution of the existing project and maintenance during the progress of the improvement.

The commerce of the year 1907 amounted to 870,556 tons, valued at $50,890,793.

The commerce consisted principally of cotton, cotton-seed meal, naval stores, manufactured lumber, shingles, fertilizers, fertilizer material, coal, gum logs, cross ties, and general merchandise.

The increase from 220,000 tons in 1869 is due to the improvement of the river.

As a result of the improvement, vessels coming to Wilmington are much larger than formerly, the average tonnage in 1886 being 421, while in 1907 the average was 1,166. This increase in tonnage has caused a corresponding decrease in freight rates on shipments by water.

References: For special descriptions, see Annual Reports of the Chief of Engineers for 1873, page 44; 1887, page 1047; 1895, page 1335; 1896, page 1131; 1901, page 1552, and 1907, page 287.

July 1, 1907, balance unexpended		$374,896.72
Amount appropriated by sundry civil act approved May 27, 1908		150,000.00
Amount received from sales, etc., during year		682.08
		525,578.80
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$195,507.50	
For maintenance of improvement	50,000.00	
		245,507.50
July 1, 1908, balance unexpended		280,071.30
July 1, 1908, outstanding liabilities		40,054.44
July 1, 1908, balance available		240,016.86
July 1, 1908, amount covered by uncompleted contracts		25,685.91
Amount (estimated) required for completion of existing project		[a] 250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[b] 500,000.00

(See Appendix M 12.)

[a] This represents only the amount yet to be appropriated under the project adopted by the river and harbor act of March 2, 1907, for completion of the 20-foot channel and securing such additional depth as funds permit.

[b] Of this amount, $100,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907.

13. Shallotte River, North Carolina.—Before improvement was begun the channel depth on the ocean bar was about 3 feet at low water and 7½ feet at high water. From the bar to a point 2¼ miles above there is a 5-foot low-water channel; the next 1¾ miles was badly obstructed by mud flats and oyster rocks, over which there was about 1 foot depth at low water. From this point to the town of Shallotte, 8 miles farther up, the river was narrow and crooked and the low-water depth varied from 2 to 12 feet.

Act of Congress approved March 2, 1907, appropriated $3,000 to be expended on this river. This appropriation not being based on any previous project, the project submitted to and approved by the Chief of Engineers for the expenditure of the funds available becomes the project.

This project is to dredge a channel 35 feet wide and 4 feet deep at low water, following the best water along the western shore, between a point 2½ miles above the inlet and a point 4 miles above the inlet.

Active work of improvement began June 22, 1908.

Amount expended on existing project to June 30, 1908, for improvement was $156.83.

The expenditures during the year were for improvement.

The river is tidal, there being a rise and fall of tide of approximately 3 feet at the town of Shallotte, which is the head of schooner navigation.

It is proposed to expend the funds available, as outlined in the present project.

The commerce for the year 1907 amounted to 9,180 tons, valued at approximately $516,872, and consisted principally of fertilizers, general merchandise, rosin, timber, etc.

The effect of the proposed improvement on freight rates is not known, but the stream affords an outlet to products, which have no other outlet except by wagon.

Reference: See Annual Report 1890, page 1184, and 1907, page 1252.

July 1, 1907, balance unexpended	$2,950.80
June 30, 1908, amount expended during fiscal year for works of improvement	107.63
July 1, 1908, balance unexpended	2,843.17
July 1, 1908, outstanding liabilities	1,082.31
July 1, 1908, balance available	1,760.86

(See Appendix M 13.)

14. Removing sunken vessels or craft obstructing or endangering navigation.—An allotment of $100 was made from this appropriation on December 26, 1907, for removing two wrecks opposite the western end of the military reservation of Fort Caswell, N. C., near the mouth of the Cape Fear River, North Carolina.

At the close of the fiscal year no work had been done.

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They

were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress, and printed in documents as indicated:

1. *Preliminary examination of White Oak River, North Carolina, from its mouth to Maysville.*—Report dated August 22, 1907, is printed in House Document No. 401, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. *Preliminary examination with plan and estimate of cost of improvement of waterway connecting Swan Quarter Bay with Deep Bay, North Carolina, with a view to obtaining a depth of 6, 7, and 8 feet, respectively.*—Reports dated August 22 and September 26, 1907, are printed in House Document No. 445, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $14,575 is presented.

3. *Examination of Cape Fear River above Wilmington, N. C., with a view to modification of the existing project.*—Report dated February 14, 1908, is printed in House Document No. 890, Sixtieth Congress, first session. A modified plan for improvement at an estimated cost of $615,000 is presented.

4. *Preliminary examination and survey of Shallowbag (Manteo) Bay, North Carolina.*—Reports dated August 21, 1907, and April 6, 1908, are printed in House Document No. 906, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $13,750 is presented.

5. *Preliminary examination and survey of South River, North Carolina, from its mouth to Aurora.*—Reports dated August 28, 1907, and March 24, 1908, are printed in House Document No. 954, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $16,000 is presented.

6. *Preliminary examination of Little River, South Carolina.*—Report dated August 29, 1907, is printed in House Document No. 530, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

The local officer was also charged with the duty of making other preliminary examinations and surveys provided for in the river and harbor act of March 2, 1907, as follows, and reports thereon will be duly submitted when received:

1. *Trent River, from Newbern to Trenton, North Carolina.*
2. *New River, from its mouth to Jacksonville, North Carolina.*
3. *Beaufort Harbor, North Carolina, with a view to a channel depth of 25 feet across the bar.*

IMPROVEMENT OF RIVERS AND HARBORS IN THE CHARLESTON, SOUTH CAROLINA, DISTRICT.

This district was in the charge of Capt. G. P. Howell, Corps of Engineers, to July 24, 1907, and of Capt. E. R. Stuart, Corps of Engineers, since that date. Division engineer, Lieut. Col. Dan C. Kingman, Corps of Engineers.

1. *Waccamaw River, North Carolina and South Carolina, and Little Pedee River, South Carolina.*—(*a*) *Waccamaw River.*—In 1880 this stream was navigable for 12-foot-draft boats at all stages of water from Georgetown, 23 miles, to Bull Creek, and at high water 4

miles farther, to Bucks lower mills; thence for 7-foot-draft boats, at high water, 22 miles farther, to Conway; thence it possessed an obstructed channel for 3-foot-draft boats, at ordinary winter water, 68 miles, to Reeves Ferry; thence an obstructed channel, with 3 feet at high water, for 30 miles, to Lake Waccamaw.

The project of improvement, adopted in 1880, provides for a channel 12 feet deep at all stages of water, with 80 feet bottom width from the mouth of the river to Conway, thence a cleared channel to Lake Waccamaw.

The original estimated cost was $29,370, which was revised in 1885 and increased in the annual report of that year to the present figure, $138,400. In the Annual Report of the Chief of Engineers for 1886, page 170, maintenance is estimated at $4,000 per year after completion of improvement.

The total expenditure to June 30, 1908, was $141,208.29. The river had been cleared of snags to a distance of 128 miles above the mouth, and this portion of the river had been frequently resnagged as appropriations permitted, 46,201 snags, etc., having been removed since June 30, 1884. Some work had been done toward increasing the original depth on eight shoals below Conway. As nearly as can be determined from the records, about $75,977.81 had been expended in originally snagging the lower 128 miles of the river and in constructing pile and plank dikes at eight shoals, and $35,435.11 in maintenance.

Dredging was begun in 1903, to obtain a 6-foot channel below Conway and to straighten the river by cutting through the worst bends. The expenditure during the year was for continuing this work at Thoroughfare Cut-off; the total amount of material removed during the year was 21,066 cubic yards, and the aggregate to June 30, 1908, 115,769 cubic yards.

The approved project is about 84 per cent completed.

The available depths reported as now existing do not differ greatly from the original depths. At mean low water about 12 feet can be carried to Bucksville, 34 miles above the mouth; 6 feet to Conway, 50 miles; about 2 feet to Wortham's bridge, 97 miles. At high water large side-wheelers can go to Red Bluff, 74 miles, and small boats to Reeves Ferry, 117 miles. The usual variation in water level is about 7.5 feet at Conway, 50 miles above the mouth, and about 12 feet at Star Bluff, 84 miles above the mouth.

The appropriation recommended will be applied to dredging and snagging the portions of the river as yet untouched.

The tidal influence at low water extends 97 miles above the mouth.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1902	141,686	$1,844,019	1905	207,630	$2,665,917
1903	143,813	1,884,700	1906	244,920	3,720,000
1904	190,435	2,119,040	1907	295,135	4,070,550

The vessels engaged in traffic on this river are steamers and tugboats of from 10 to 550 tons, seagoing schooners of from 300 to 500 tons, pole boats, rafts, etc. The additional work proposed is necessary to make the improvement available.

No new line of transportation was established during the year.

For references to examinations and surveys see page 246, Annual Report of the Chief of Engineers, 1904.

It has been found impossible to obtain information concerning the effect of the improvement on freight rates.

July 1, 1907, balance unexpended	$15,432.22
June 30, 1908, amount expended during fiscal year for works of improvement	12,940.51
July 1, 1908, balance unexpended	2,491.71
July 1, 1908, outstanding liabilities	461.98
July 1, 1908, balance available	2,029.73
Amount (estimated) required for completion of existing project	28,800.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *Little Pedee River.*—The river in its original condition was much obstructed by snags and overhanging trees and by 10 bridges without draws. In places it was divided into several branches, in none of which was there a good channel.

Under the plan of improvement adopted in 1888 it is proposed to snag the river and close unnecessary branches, providing for steamboat navigation up to the mouth of Lumber River, 65 miles, and for pole-boat navigation 48 miles farther, to Little Rock, at an estimated cost of $50,000.

The total expenditures to June 30, 1908, were $25,053.01. The river had been well snagged up to the mouth of Lumber River and roughly cleared for pole-boat navigation to Little Rock. No work had been done toward increasing the original depths. As nearly as could be determined from the records, about $19,549.99 had been expended in originally snagging the river, and about $5,503.02 in maintenance. About 50 per cent of the project has been completed.

There were no operations during the year.

The aggregate number of obstructions removed since beginning of the improvement in 1888 is 31,718.

The appropriation recommended will be applied to snagging portions of the river as yet untouched.

The available depths now existing do not probably differ greatly from the original depths. No permanent improvement can be effected toward increasing the maximum draft over the shoals without considerable dredging, which was not provided for in the original project. The usual variation in water level at Gilchrist bridge, about 65.5 miles above the mouth, is about 9.5 feet.

[a] See consolidated money statement on page 309.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	4,614	$52,760	1900	23,780	$173,500
1892	7,115	92,964	1901	51,460	399,000
1893	6,153	101,535	1902	57,050	416,000
1894	8,375	114,600	1903	77,750	560,500
1895	12,438	117,470	1904	83,100	645,000
1896	17,050	198,500	1905	87,985	663,650
1897	13,162	100,400	1906	18,880	389,500
1898	11,900	105,750	1907	14,513	243,250
1899	16,685	144,787			

Vessels ply on the river as far as Gallivant's bridge, 47 miles above its mouth; the river is probably navigable at its mean low-water stage for boats with 3-foot draft as far as Gallivant's bridge. No new line of transportation was established during the year.

The balance on hand will be spent in maintaining the channel.

For outline map of river see page 1214, Annual Report of the Chief of Engineers for 1890. For preliminary examination and survey see page 1111, Annual Report of the Chief of Engineers for 1887.

It has been found impossible to obtain information as to the effect of the improvement on freight rates.

July 1, 1907, balance unexpended	$1,646.99
July 1, 1908, balance unexpended	1,646.99
Amount (estimated) required for completion of existing project	23,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

CONSOLIDATED.

July 1, 1907, balance unexpended	$17,079.21
June 30, 1908, amount expended during fiscal year for works of improvement	12,940.51
July 1, 1908, balance unexpended	4,138.70
July 1, 1908, outstanding liabilities	461.98
July 1, 1908, balance available	3,676.72
Amount (estimated) required for completion of existing project	52,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	25,000.00

(See Appendix N 1.)

2. Lynch River and Clark Creek, South Carolina.—Lynch River is a tributary of the Great Pedee River, into which it flows a few miles below Smiths Mills at a point about 65 miles above the mouth of the Great Pedee River. Shortly above this point a branch of Lynch River, known as Clark Creek, leaves it, and, flowing about

[a] See consolidated money statement on this page.

7 miles, empties into the Great Pedee River about 10½ miles below the mouth of Lynch River. The mouth of Lynch River was completely filled with drift coming in from the Great Pedee River, thus forcing all traffic to come down Clark Creek. Its upper end was also choked by this drift.

The project of improvement adopted in 1888 provided for roughly clearing a channel in Clark Creek, to afford an outlet for Lynch River. The estimated cost was $7,500. The money was appropriated from 1888 to 1892, inclusive, and was expended in roughly clearing a channel 40 feet wide and 3 feet deep. As no further appropriations were made, the channel filled up and no permanent improvement was effected.

The river and harbor act of March 2, 1907, appropriated $2,000 for improving Lynch River and Clark Creek by the removal of logs and snags. The adopted project provides for removing obstructions, as far as the funds will permit, to permit the passage of rafts through the lower end of Clark Creek through a small connecting stream between Clark Creek and Lynch River, known as Lawrence Cut, and through Lynch River.

Operations during the year consisted in snagging in Clark Creek and Lawrence Cut and clearing about 8 miles of channel.

Commercial statistics.

Year.		Tons.	Value.
1906	Outward freights, logs	3,552	$13,000
1907	Outward freights, logs	1,500	15,000

There is no other commerce on this stream.

There is no navigation save by rafts.

For map of Clark Creek, see page 1204, Annual Report of the Chief of Engineers, 1890. For reports of examinations of Lynch River, see Annual Reports of the Chief of Engineers for 1881, page 1038; 1893, page 1532, and 1900, page 1877.

July 1, 1907, balance unexpended	$1,855.42
June 30, 1908, amount expended during fiscal year for works of improvement	1,225.67
July 1, 1908, balance unexpended	629.75

(See Appendix N 2.)

3. Great Pedee River, South Carolina.—The river in its original condition was dangerously obstructed by logs everywhere. Boats drawing 9 feet of water were able to reach Smiths Mills, 52 miles above the mouth. Those drawing 3½ feet could get 54 miles farther up at low water to Little Bluff, or at high water to Cheraw, 167 miles from the mouth.

The project of improvement adopted in 1880 provides for a thoroughly cleared 9-foot navigation to Smiths Mills and a 3½-foot navigation to Cheraw at all stages of water.

The original project contained no estimate of cost. From 1880 to 1886, inclusive, $47,000 was appropriated. In the Annual Report of the Chief of Engineers for 1886, page 170, it was estimated that

$70,000 in addition to this $47,000 would complete the improvement, and that $5,000 a year would be required for maintenance.

A project for the improvement of the upper river (the 64 miles between Cheraw and the bridge of the Wilmington, Columbia and Augusta Railroad) was adopted in 1902. (See Annual Report of the Chief of Engineers for 1901, p. 1607.) This project provides for obtaining, by snagging and dredging, a cleared channel, with a least depth of 3½ feet at mean low water, at a cost of $118,300; and the work was placed in the continuing-contract class. This total amount has been appropriated.

The total expenditures to June 30, 1908, were $222,912.66. Of this amount the sum of 28 cents was received on account of refundment of overpayment. The river had been well cleared of snags from the mouth to the Wilmington, Columbia and Augusta Railroad bridge, 103 miles, and less thoroughly snagged between the bridge and Cheraw, 44,733 snags, etc., having been removed since June 30, 1884.

As nearly as could be determined by the records, about $78,919.13 had been expended in originally clearing the river of snags and in preliminary examination and survey made in 1900, and about $49,319.69 in maintenance.

The expenditures during the year were for operation of dredge and snag boats, for prosecuting the improvement, and for maintenance in the removal of 191,238 cubic yards of dredged material and 3,815 obstructions.

About 88 per cent of the approved project for the upper river has been completed up to June 30, 1908. The contemplated depth (3½ feet) has been attained at eleven shoals on the upper portion of the river.

The appropriation recommended will be applied to redredging and snagging for maintenance of the improvement.

At mean low water 8 feet can be carried to Smiths Mills, 52 miles above the mouth; about 3 feet to the Wilmington, Columbia and Augusta Railroad bridge, 103 miles above, and about 2 feet to Cheraw, the head of navigation, 167 miles above.

The usual variation in water level is 16.4 feet at Smiths Mills and 34.2 feet at Cheraw.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	62,344	$1,367,330	1900	154,727	$2,645,560
1892	92,471	1,401,038	1901	188,912	2,811,080
1893	94,661	1,166,874	1902	152,008	1,328,970
1894	91,025	1,169,070	1903	153,014	1,338,759
1895	106,115	893,430	1904	162,566	1,507,181
1896	229,964	1,325,250	1905	148,869	1,618,551
1897	114,177	1,167,914	1906	175,250	1,751,175
1898	75,280	1,228,885	1907	229,898	1,957,388
1899	134,072	1,692,709			

The vessels engaged in traffic on this river are steamers of 400 tons and less, seagoing schooners, pole boats, rafts, etc. One new line of transportation was established during the year.

For references to examinations and surveys, see page 249, Annual Report of the Chief of Engineers for 1904.

It has been found impossible to obtain information as to the effect of the improvement on freight rates.

July 1, 1907, balance unexpended		$70,488.09
Amount appropriated by sundry civil act approved May 27, 1908		11,300.00
		81,788.09
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$32,153.98	
For maintenance of improvement	7,246.49	
		39,400.47
July 1, 1908, balance unexpended		42,387.62
July 1, 1908, outstanding liabilities		3,450.05
July 1, 1908, balance available		38,937.57
July 1, 1908, amount covered by uncompleted contracts		4,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix N 3.)

4. Winyah Bay, South Carolina.—This large bay is connected with the ocean by a passage between the shores of North and South islands 2½ miles long, 1 mile wide at the bay, three-fourths mile wide at the gorge, and 1¼ miles wide at the ocean, or southeasterly, end of North Island. Through the passage, which trends north-northwest and south-southeast, there was a bold channel 36 feet deep at the bay, retaining a depth of not less than 20 feet until about 3,000 feet southerly from the end of North Island and of not less than 15 feet to a point about 1 mile south of the island, where the channel divided into two. One of these two channels, known as Main channel, continued 3¼ miles farther, through extensive shoals, to the 18-foot contour in the ocean. This channel was south-southeast and in alignment with the main channel through the straits. The other, known as Bottle channel, after flowing about 2,500 feet southeasterly, 1,500 feet easterly, and about 3,000 feet northeasterly, reached the 18-foot contour in the ocean at a distance of about 1½ miles in a direction from the point of separation from the main ship channel almost at right angles with the direction of that channel and of the channel through the passage. At mean low water the depth on the crest of the bar was variable in both channels and about 7 to 9 feet in Main channel and 6 to 8 feet in Bottle channel. The mean range of tide is 3½ feet.

The present project, adopted in 1889, provides for the construction of two jetties, springing, respectively, from North and South islands and converging toward the bar, the jetties to consist of mattress foundation and a superstructure of large riprap stone raised to a height of 6 feet above mean low water, the south jetty to extend due east across the bar and the north jetty to converge toward it, so as to produce the necessary contraction on the bar. The depth to be secured is 15 feet at mean low water. The river and harbor act of June 3, 1896, authorized the completion of the work under continuing-contract system, at a cost not exceeding $1,996,250, in addition to the $20,000 appropriated by the act. The entire amount has been appropriated by sundry civil acts since that date. The project was ex-

tended by the river and harbor act approved June 13, 1902, to permit dredging at the shoal places in Winyah Bay, between the entrance and the city of Georgetown, S. C., over which the least channel depths might at any time be less than at the entrance to the bay, provided that the expenses of this dredging, added to that of improving the entrance to the bay, should not exceed the total amount authorized under the continuing-contract system.

The total expenditures to June 30, 1908, were $2,442,912.55, of which $428,750 was appropriated prior to June 3, 1896. Of this amount $6,252.36 was derived from miscellaneous sources, such as rent of dredge, auction sales, etc. For maintenance $69,410.41 has been spent. The jetty work, which since June 3, 1896, had been under a continuing contract, had been completed. The north jetty extends a distance of 11,139 feet from the shore end, with crest from 4½ to 6 feet above mean low water, except the outer 100 feet, which is submerged. The south jetty extends a distance of 21,051 feet from the shore end, with crest at heights varying from 10 feet above mean low water at the inner end to nothing at the outer end. The stone superstructure has practically no top width. A stone mound, 50 feet long, 30 feet wide, and 12 feet above low water had been constructed to mark the outer end of the south jetty. The seagoing suction dredge *Winyah Bay* has been built, and this dredge and the similar dredge *Charleston* have removed 1,553,265 cubic yards of material from the entrance channel and 1,007,393 cubic yards of material from the eastern channel in upper Winyah Bay and Sampit River shoal. Spur dikes have been built to protect the South Island beach. A mud dike has been built from the high land on South Island to the high land near the Santee River to prevent the tides from cutting around the shore end of the south jetty, and the stonework of the jetty has been extended about 2,600 feet by a work of sheet piling covered with mud to connect with this dike.

About 95 per cent of the approved project has been completed up to June 30, 1908. A slight shoaling has occurred during the year in a portion of the channel where the depth is slightly less than 15 feet; this shoal place will be removed early in coming fiscal year. The mean range of tide is 3½ feet.

The appropriation recommended will be applied to dredging for maintenance of the improvement.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	261,370	$8,071,600	1900	129,639	$6,749,433
1892	271,986		1901	247,989	8,157,906
1893	268,640		1902	387,171	9,310,682
1894	223,822		1903	368,502	9,359,581
1896	171,050	6,228,350	1904	399,774	9,546,843
1897	149,374	5,817,950	1905	393,916	10,401,879
1898	125,003	5,587,890	1906	392,770	10,139,751
1899	120,587	6,337,853	1907	382,915	9,432,575

The vessels using the entrance channel are steamers of 1,850 tons and less and sailing vessels of various kinds. The freight carried is principally lumber, naval stores, and general merchandise. There are three lines of steamships plying between Georgetown and north-

ern ports. The water rate on lumber, the chief export, had decreased from $5.50 per thousand feet B. M. in 1892 to $4.12½ in 1905, but it has since advanced to $6.

For references to examinations and surveys see page 250, Annual Report of the Chief of Engineers for 1904.

July 1, 1907, balance unexpended		$119,344.76
Received, account sales and overpayment		4.62
		119,349.38
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$41,732.15	
For maintenance of improvement	29,277.42	
		71,009.57
July 1, 1908, balance unexpended		48,339.81
July 1, 1908, outstanding liabilities		6,950.83
July 1, 1908, balance available		41,388.98
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		15,000.00

(See Appendix N 4.)

5. *Mingo Creek, South Carolina.*—To June 30, 1897, $17,000 had been expended on improvement to provide steamboat navigation up to Williams Landing and pole-boat navigation at high water up to the head of navigation by snagging and clearing the banks.

Deterioration having occurred, the sum of $300 was allotted from the emergency appropriation provided by the river and harbor act of March 2, 1907, of which $257.75 has been expended during the fiscal year 1908, for removing the worst obstructions to navigation.

Amount allotted March 18, 1908, from emergency appropriation act of March 2, 1907	$300.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	257.75
July 1, 1908, balance unexpended	42.25

(See Appendix N 5.)

6. *Santee, Wateree, and Congaree rivers, and Estherville-Minim Creek Canal, South Carolina.*—(*a*) *Santee River and Estherville-Minim Creek Canal.*—This river in its original condition was considerably obstructed at all stages of water by sunken logs and snags. Its bar entrance was narrow, crooked, and shifting, with only about 4 feet of water at low tide, and so situated as to be difficult and expensive to improve.

The original project, adopted in 1880, contemplated providing an outlet for the river into Winyah Bay by constructing a canal from the river through Mosquito Creek into the bay. On this project there was expended $99,750.

The present project, adopted in 1889, contemplates providing a more satisfactory outlet into the bay by cutting a canal 70 feet wide and 6 feet deep at mean low water from the Estherville plantation to Minim Creek and for snagging the entire river. The estimated cost is $350,000, not including the amount expended under the original project.

The total expenditures under the present project to June 30, 1908, were $226,900.38, of which about $42,314.64 was for maintenance; of this, $32.50 was derived from sales at auction, etc. All the expenditure during the year was for maintenance, and consisted of the removal of 73,312 cubic yards of material and 211 stumps and logs from the canal, widening and deepening same. The first cut of the canal had been made entirely through, and this had been widened through a portion of its length. From the Santee River proper 1,809 obstructions had been removed.

The approved project is about 84 per cent completed.

Except at the Winyah Bay end, where on account of the softness of the banks the width has been reduced to 40 feet, the canal is 50 feet wide and 6 feet deep. The mean rise of tide at the canal is about 3½ feet. The least available depth in Santee River is about 4 feet at low water. The usual variation in water level at the Atlantic Coast Line bridge, about 54½ miles above the mouth, is about 19 feet, and at its junction with the Wateree and Congaree rivers, 143 miles above the mouth, about 20 feet. The river is navigable its entire length.

During the year the construction of a suction dredge was begun, for which the appropriation for this stream bears a part of the cost. For this there was an expenditure of $1,077.70. For repairs to snag boat $1,211.02 was expended, and for repair to sawmill plant at Smithville, superintendence, etc., the sum of $6,524.47 was expended.

The appropriation recommended will be applied to widening the Estherville-Minim Creek Canal, and to removing bars and obstructions from Santee River.

The additional work proposed is necessary to make the improvements available and for extending the benefits.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	100,255	$2,743,000	1900	179,090	$2,622,200
1892	110,523	2,775,800	1901	204,375	1,809,000
1893	124,182	2,679,600	1902	215,600	1,882,500
1894	115,428	2,375,000	1903	220,900	1,840,000
1895	117,690	2,224,800	1904	242,800	1,662,500
1896	134,135	2,204,600	1905	329,350	1,485,000
1897	134,206	2,159,940	1906	427,300	1,830,000
1898	112,205	2,203,800	1907	474,750	1,735,000
1899	154,327	2,679,100			

The vessels using the river and canal are steamers of from 10 to 500 tons, small sailing craft, pole boats, rafts, etc.

For references to examination and surveys and other information concerning the work see page 252, Annual Report of the Chief of Engineers, 1904.

It has been found impossible to obtain information as to the effect of the improvement on freight rates.

July 1, 1907, balance unexpended		$36,884.64
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$12,400.42	
For maintenance of improvement	3,352.10	
		15,752.52
July 1, 1908, balance unexpended		21,132.12
July 1, 1908, outstanding liabilities		1,527.01
July 1, 1908, balance available		19,605.11

July 1, 1908, amount covered by uncompleted contracts	$3,416.67
Amount (estimated) required for completion of existing project	109,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*b*) *Wateree River.*—In its original condition this stream had a low-water depth of from 3 to 4 feet from its mouth, 67 miles, to Camden. The lower 14 miles was completely blocked at all stages of water by logs, snags, etc., and at moderate stages by the bridges of the South Carolina and the Wilmington, Columbia and Augusta railroads, then without draw spans; thence to Camden navigation was possible, but dangerous, except during high water. Its commerce was practically nothing.

The present project of improvement, adopted in 1881, provides for safe and unobstructed 4-foot navigation for steamers from Camden to the mouth, at an estimated cost of $60,000.

The appropriation of September 19, 1890, completed the estimate for the project, but appropriations have since been made for maintenance. The work is one of snagging only, and as snags are continually lodging, it is not susceptible of completion. Snagging work should be done annually in order to keep the channel open.

The total expenditures to June 30, 1908, were $101,457.02. To June 30, 1900, the river had been kept fairly clear of obstructions from the mouth to Camden. Work was suspended in 1899, and was resumed in May, 1907, a snag boat having been built for this stream. All the expenditures during the year were for maintenance.

Snagging was done during the year and a total of 2,426 obstructions were removed at a cost of $5,724.23.

Toward the construction of a suction dredge an expenditure of $2,083.15 was made, and for the construction of snag boat $245.18. For superintendence, repairs to plant and property, etc., there was expended $3,432.10.

The appropriation recommended will be applied to snagging for maintenance of the improvement.

The additional work proposed is necessary to make the improvement available.

So far as known the available depths now existing do not differ greatly from the original depths. The usual variation in water level is about 17 feet at a point about 4 miles above the mouth, and about 28.5 feet at Camden, 67 miles above the mouth.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	1,005	$51,210	1900	93,024	$155,000
1892	2,244	86,040	1901	10,417	50,000
1893	6,242	117,729	1902	42,575	92,500
1894	18,075	94,331	1903	41,050	87,000
1895	21,697	127,565	1904	15,600	29,700
1896	35,002	233,525	1905	22,000	41,000
1897	43,770	202,800	1906	16,200	81,000
1898	83,568	274,050	1907	56,400	564,000
1899	109,170	272,200			

[a] See consolidated money statement on page 319.

Rafting is the only business done on this river. No new line of transportation was established during the year.

For references to examinations and surveys see page 253, Annual Report of the Chief of Engineers, 1904.

It has been found impossible to obtain information as to the effect of the improvement on freight rates.

July 1, 1907, balance unexpended	$57,527.64
June 30, 1908, amount expended during fiscal year for maintenance of improvement	11,484.66
July 1, 1908, balance unexpended	46,042.98
July 1, 1908, outstanding liabilities	2,269.25
July 1, 1908, balance available	43,773.73
July 1, 1908, amount covered by uncompleted contracts	12,612.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(c) *Congaree River.*—In 1886 this stream in its original condition had a low-water depth of 3 to 4 feet from its mouth to the railroad bridge at Columbia, thence 1 foot low-water depth 2 miles farther to its head. The navigation of the lower 49 miles was blocked at all stages of water by the South Carolina Railroad bridge and by sunken logs, snags, and overhanging trees. The navigation of the remaining 2 miles was prevented by swift currents and numerous rock ledges and bowlders. Its commerce was nothing.

The project of improvement adopted in 1886 proposes to secure a thoroughly cleared 4-foot navigation over the lower 49 miles at all stages of water and a cleared channel through the rock ledges and bowlders above at an estimated cost of $54,500. This project was modified in 1899, when a lock and dam was authorized for extending steamboat navigation through these ledges and bowlders in the river from Gervais Street Bridge, Columbia, to Granby. The open-channel work above Granby was thus eliminated. Appropriations for the lock and dam were made, amounting to $250,000, $25,000 of which, by authority of Congress, was alloted for the open-channel work. The lock and dam had been completed with the $225,000, and considerable work done in clearing the channel between the lock and the city of Columbia.

The river and harbor act of March 2, 1907, contained the following proviso in appropriating for this stream: "And the limits of the improvement of the Congaree River shall be extended to include that part of the said river included in the project from Gervais Street Bridge, Columbia, to Granby, South Carolina." Under this authority the work on the entire length of the river will be prosecuted under allotments from appropriations for improving Santee, Wateree, and Congaree rivers, and the Estherville-Minim Creek Canal, South Carolina.

In 1905 a survey of the river between the lock and dam and the mouth of the river, made to determine what additional work was

[a] See consolidated money statement on page 319.

required to form a 4-foot channel at all stages of water, showed that in addition to clearing the river of obstructions by snagging, dredging was also required, and that the estimated cost of the project should be increased accordingly. To obtain and maintain this channel would cost $20,000 a year for four years, after which a yearly expenditure of $10,000 would probably suffice.

The total expenditures for open-channel work to June 30, 1908, were $101,513.17, of which 50 cents was derived from refundment of overpayment. The channel had been thoroughly snagged from the mouth to Granby, 2 miles below Columbia. A total of 16,350 obstructions had been removed below Granby. Dredging had been carried on at Barbours Cut, removing 10,859 cubic yards of sand and pebbles. Work had been in progress of clearing the channel above the lock. As nearly as can be determined from the records about $34,282.35 has been applied to work of maintenance.

Snagging was done during the year and a total of 1,596 obstructions were removed at a cost of $4,588.55.

For the construction of a suction dredge an expenditure of $3,812.31 was made; for repairs to plant and property $3,596.69, and in clearing the channel above the lock $24,821.86 was expended. During the year approximately 4,039 tons of rock was removed. This rock excavation made it possible for steamers to land at the foot of Senate street, Columbia, S. C.

The appropriation recommended will be applied to work of improvement in removing bars and obstructions between the mouth and Columbia.

The usual variation in water level at a point 2 miles above the mouth is about 24.3 feet and at Columbia about 33.2 feet.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1891	2,401	$17,840	1900	121,363	$197,000
1892	3,686	62,025	1901	14,583	70,000
1893	2,781	71,125	1902	58,075	123,500
1894	7,974	40,760	1903	114,310	271,400
1895	8,993	45,700	1904	43,035	93,900
1896	18,307	178,900	1905	34,350	252,000
1897	40,857	110,100	1906	35,522	821,100
1898	81,362	201,700	1907	73,833	1,234,000
1899	88,696	191,700			

A steamboat line between Columbia and Georgetown, S. C., has been established. Connection is made at Georgetown with steamers for New York, Baltimore, and Charleston. Boats are now landing at foot of Senate street, Columbia, S. C., the present head of navigation. A reduction of from 22 to 30 per cent in freight rates from Columbia to New York (difference between rail and water transportation) has been effected by the improvement.

For preliminary examination and survey, see page 1140, Annual Report of the Chief of Engineers for 1885. For outline map of river, see page 1194, Annual Report of the Chief Engineers for 1889.

For project for construction of lock and dam, see page 1182, Annual Report of the Chief of Engineers for 1896.

Reference to report on examination made in compliance with the river and harbor act of March 2, 1907, will be found on page 323 of this report.

July 1, 1907, balance unexpended		$63,745.24
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$29,072.67	
For maintenance of improvement	8,185.24	
		37,257.91
July 1, 1908, balance unexpended		26,487.33
July 1, 1908, outstanding liabilities		2,070.73
July 1, 1908, balance available		24,416.60
July 1, 1908, amount covered by uncompleted contracts		8,883.33
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

CONSOLIDATED.

July 1, 1907, balance unexpended		$158,157.52
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$41,473.09	
For maintenance of improvement	23,022.00	
		64,495.09
July 1, 1908, balance unexpended		93,662.43
July 1, 1908, outstanding liabilities		5,866.99
July 1, 1908, balance available		87,795.44
July 1, 1908, amount covered by uncompleted contracts		24,912.00
Amount (estimated) required for completion of existing project		109,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		60,000.00

(See Appendix N 6.)

7. *Operating and care of lock and dam across Congaree River, near Columbia, S. C.*—This service is provided for by the permanent indefinite appropriation for operating and care of canals and other works of navigation, under the provisions of section 4 of the river and harbor act of July 5, 1884.

The operation and care of the lock and dam across the Congaree River have been provided for by allotments from this appropriation since April 7, 1906. The expenditures during the fiscal year were $5,303.51; the total expenditures have been $10,803.51.

(See Appendix N 7.)

8. *Inland waterways between Charleston Harbor, South Carolina, and opposite McClellanville.*—These waterways consist of a series of creeks, sounds, rivers, and bays, which afford a route sheltered for the most part from the sea by the numerous islands which form the outer coast line. The route is tidal throughout, the range of tide varying from about 4.6 to 5.3 feet. It is now obstructed by a number of shallow reaches and narrow, crooked passages, particularly at points where the tides meet. The passage across Bulls Bay, besides being

[a] See consolidated money statement on this page.

very shallow, is much exposed. The present commerce is comparatively small, as only very small vessels can get through without excessive delays.

The plan of improvement adopted in 1902 provides for a channel between Charleston Harbor and opposite McClellanville 4 feet deep at mean low water and 60 feet bottom width, at an estimated cost of $125,290. The project was modified by the river and harbor act of March 2, 1907, to provide for a branch of the channel to Morrisons Landing in McClellanville. The new channel will partly follow the present channels and will partly lie in cuts across the marsh to avoid crooked and dangerous sections. It will pass to the northward of Bulls Bay. A revised estimate made during the fiscal year 1908, based upon work already done, shows that to complete the improvement there will be required $66,000 in addition to the amount originally estimated.

The total expenditures to June 30, 1908, were $77,484.72. A contract was let in 1905, under which there was removed 158,441 cubic yards; a second contract was made during the present fiscal year for continuing the work, and under this there has been removed 183,857 cubic yards, making a total of 342,298 cubic yards, which is about 46 per cent of the approved project.

The appropriation recommended will be applied to prosecution of the improvement by dredging between Grahams Creek and McClellanville.

The improvement can have no effect on freight rates until the project shall have been completed.

For references to reports of examinations and surveys, see page 256, Annual Report of the Chief of Engineers for 1904.

Commercial statistics.

Year.	Tons.	Value.	Year.	Tons.	Value.
1903	33,344	$579,520	1906	49,440	$797,747
1904	39,064	573,770	1907	36,230	921,675
1905	58,421	608,761			

July 1, 1907, balance unexpended	$107,441.12
June 30, 1908, amount expended during fiscal year for works of improvement	59,635.84
July 1, 1908, balance unexpended	47,805.28
July 1, 1908, outstanding liabilities	3,592.88
July 1, 1908, balance available	44,212.40
July 1, 1908, amount covered by uncompleted contracts	34,591.88
Amount (estimated) required for completion of existing project	66,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	66,000.00

(See Appendix N 8.)

9. Charleston Harbor, South Carolina.—There were originally four channels across the bar, the deepest having about 12 feet depth at low water. Commerce was then using the Pumpkin Hill channel, about 3 miles south of the present jetty channel. Where the present jetty channel is situated there was then the Swash channel, with a best depth of 10½ feet of water, too crooked for safe use. The natural channels were shifting in position and variable in depth.

The original project, adopted in 1878, provided for establishing and maintaining, by means of two jetties and auxiliary dredging, a low-water channel of not less than 21 feet depth across the bar. The Swash channel was selected for improvement. The estimated cost was $3,000,000.

In 1888 it became necessary to modify the height of the crest line of the jetties and to revise the estimate. This increase in the estimate was largely due to the fact that money had been appropriated so slowly that reasonable contract prices could not be obtained. The annual appropriation up to that time had been only 5½ per cent of the original estimate. In the revised project the jetties were increased in height and length, but no change was made in their position or distance apart. The revised estimates were $4,380,500 if the jetties were brought up to low-water level throughout, and $5,334,500 if brought up 3 feet higher. The former estimate was adopted by Congress in the river and harbor act approved July 13, 1892.

The present project, adopted by the river and harbor act approved March 3, 1899, provides for obtaining a channel at the entrance to Charleston Harbor not less than 26 feet deep at mean low water (mean range of tide about 5.2 feet) and 600 feet wide, by constructing a large seagoing suction dredge, at a cost not exceeding $150,000, and operating her, together with the existing dredge *Charleston*, for three years. The estimated cost of constructing the new dredge and operating it, as above, was $285,000. Of this amount $175,000 had been appropriated prior to the enactment of the river and harbor act of June 13, 1902, which made available an additional sum of $208,000, increasing to $383,000 the amount authorized for the project for the new dredge and its operation. The entire amount authorized has been appropriated.

The total expenditures to June 30, 1908, were $4,641,010.36, including about $2,500 expended at Sullivans Island and $10,000 at Mount Pleasant; of this sum $7,823.23 was derived from miscellaneous sources, such as rental of dredge, auction sales, etc. Of this amount, $4,172,500 had been expended on the original project and on maintenance.

The project had been completed, as the full depth of 26 feet at mean low water had been obtained and the full width of 600 feet, except for a short distance near the inner end of the jetties, where the width was 550 feet. The mean tidal range is 5.2 feet.

The operations during the year were for maintenance.

The appropriation recommended will be applied to dredging for maintenance of the improvement.

The wreck of the steamer *Housatonic*, owing to its proximity to the present lighted range, has become a menace to navigation, and its removal in the near future is contemplated

The river and harbor act of March 3, 1905, authorizes the Secretary of War, in his discretion, to cause the new dredges employed on this work to be utilized, at such times as they are not employed in dredging on the outer bar, for dredging in the channels between said outer bar and the city of Charleston.

For references to examinations and surveys and to projects see page 257, Annual Report of the Chief of Engineers for 1904.

COMMERCIAL STATISTICS.

[Furnished by the collector of customs.]

Foreign commerce.

Year.	Aggregate registered tons.	Value.	Year.	Aggregate registered tons.	Value.
1889	211,203	$16,741,951	1899	174,525	$6,385,168
1890	224,962	16,041,397	1900	150,631	11,170,910
1891	274,149	23,110,664	1901	141,003	5,276,757
1892	169,379	11,829,607	1902	219,069	7,095,294
1893	193,336	11,940,129	1903	142,196	5,237,119
1894	208,169	11,560,372	1904	146,966	6,100,295
1895	140,938	10,586,326	1905	106,351	3,337,028
1896	158,325	11,785,816	1906	132,400	4,165,567
1897	226,750	12,106,763	1907	174,219	6,036,866
1898	214,180	10,956,250			

Commerce through Charleston Harbor, ocean entrance.

Year.	Total imports and exports.	Value.
	Tons.	
1901	784,812	$29,454,515
1902	822,845	34,746,997
1903	685,903	47,659,427
1904	880,596	49,991,894
1905	858,016	51,631,040
1906	835,360	56,301,096
1907	722,338	56,138,444

Regarding effect on freight rates since improvement began in 1878, the only change that seems due to the improvement is a lowering of about 12½ cents per ton on business done by coastwise sailing vessels.

The additional work proposed is for maintenance.

July 1, 1907, balance unexpended	$25,688.12
Received account of sales	337.93
	26,026.05
June 30, 1908, amount expended during fiscal year for maintenance of improvement	8,713.18
July 1, 1908, balance unexpended	17,312.87
July 1, 1908, outstanding liabilities	308.36
July 1, 1908, balance available	17,004.51
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	25,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix N 9.)

10. Removing sunken vessels or craft obstructing or endangering navigation.—An allotment of $800 was made June 1, 1908, for the purpose of making an examination of the wreck of the steamer *Housatonic*, near the entrance to Charleston Harbor, South Carolina, with a view to its removal. An agreement was made for the services of a diving party in connection with the examination of the wreck, but no work had been done and no expeditures made under the allotment at the close of the fiscal year.

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination and survey of Shem River, South Carolina.—Reports dated June 3 and October 14, 1907, respectively, are printed in House Document No. 224, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. Preliminary examination, with plan and estimate of cost of improvement, of Shipyard River or Creek, South Carolina.—Reports dated April 22 and July 24, 1907, are printed in House Document No. 452, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

3. Preliminary examination of North Fork, Edisto River, South Carolina, from its mouth to Orangeburg.—Report dated July 20, 1907, is printed in House Document No. 515, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

4. Preliminary examination of South Fork, Edisto River, South Carolina, from its mouth to Scotts bridge.—Report dated July 20, 1907, is printed in House Document No. 516, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government except as indicated in connection with other streams in the vicinity, by snagging when suitable plant is available.

5. Preliminary examination of Congaree River, South Carolina, and Broad River from its mouth to Ninety-nine Island shoals.—Report dated December 20, 1907, is printed in House Document No. 650, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

6. Preliminary examination of Saluda River, South Carolina, between Columbia and Hollow Creek.—Report dated December 19, 1907, is printed in House Document No. 651, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

The local officer was also charged with the duty of making a preliminary examination and survey of *Great Pedee River, South Carolina, from Georgetown to Pedee Station*, provided for in the river and harbor act of March 2, 1907, and reports thereon will be duly submitted.

IMPROVEMENT OF RIVERS AND HARBORS IN THE SAVANNAH, GEORGIA, DISTRICT.

This district was in the charge of Lieut. Col. Dan C. Kingman, Corps of Engineers, division engineer, southeast division.

1. Savannah Harbor, Georgia.—This covers the estuary of the Savannah River from about 2 miles above the city of Savannah to the ocean bar, about 22 miles below the city. In 1873 the channel was in places not more than 9 feet deep at mean low water.

The first appropriation for the improvement of this harbor was made in 1826, and had reference to the removal of natural and artificial obstructions, but the first comprehensive plan of improvement is dated February 11, 1853. Another, for the removal of obstructions, is dated about 1871.

A later plan of improvement is dated August 28, 1873, and was supplemented March 19, 1879. It contemplated the establishment of a channel from the city to the sea, practicable at high tide for vessels drawing 22 feet of water. This project was replaced by an enlarged one (January 16, 1882, Annual Report of the Chief of Engineers for 1882, Appendix J 4) contemplating the same channel depth. The amount expended under these projects up to June 30, 1890, was $1,875,061.59.

The project in force up to June 13, 1902, adopted in 1890, providing for a mean high-water depth of 26 feet from the city to the sea, is printed as part of Appendix O, Annual Report of the Chief of Engineers for 1890. The channel depth contemplated by it was reported as having been obtained at the end of the fiscal year 1896. While the project depth was literally obtained, the channel was very crooked and of much less than the project width.

A supplemental plan of improvement was submitted December 7, 1894, providing for a detached extension of the Oyster Bed training wall, for the purpose of sheltering the anchorage in Tybee Roads, as well as for protecting the ship channel over the outer part of Tybee Knoll against the destructive action of heavy storms. This project, which is printed as part of Appendix M 1 of the Annual Report of the Chief of Engineers for 1895, was authorized by act of Congress of June 3, 1896, its estimated cost being $992,250. The same act authorized the completion of work for improving the inside route from Savannah, Ga., to Beaufort, S. C., at an additional cost of $106,700, and dredging for maintenance in Savannah Harbor, and the sum of $1,005,000 was appropriated to complete these works.

The amount expended under the project of 1890 up to June 30, 1896, was $3,460,049.99, of which $974,504.88 was for dredging and $2,356,720.10 for contraction work. There had previously been expended $1,875,061.59, giving a total of $5,335,111.58. Between June 30, 1896, and June 30, 1902, $712,918.84 was expended on the modified 26-foot project, of which $84,850.98 was for maintenance.

From the time of the reported completion of the project of 1890, in July, 1896, until June 30, 1902, extensive dredging was done, both for maintenance and as part of the modification of the project.

On June 13, 1902, Congress adopted a project which provided for the establishment of a channel from the Old Waterworks (2 miles above Savannah) to the ocean, 28 feet deep at mean high water, with bottom widths of 350 to 500 feet, to be accomplished by dredging and

the raising of all existing training walls between Savannah and Tybee Roads. It also provided for the construction of mooring dolphins at two points in the harbor—the "Bight" and Venus Point. The estimated cost of the work was originally $1,567,791. This amount was increased by $210,000 by the act of Congress approved March 3, 1905. This project will be found printed in House Document No. 123, Fifty-sixth Congress, second session, and also in the Annual Report of the Chief of Engineers for 1901, page 1723.

The river and harbor act of March 3, 1905, called for a resurvey of Savannah Harbor, Georgia, with plans and estimates of cost, with a view to securing a channel to the sea 26 feet deep at mean low water. The survey was made and the plans and estimates prepared, and will be found printed as House Document No. 181, Fifty-ninth Congress, first session. This project was not adopted by Congress in its entirety, but the river and harbor act of March 2, 1907, appropriated $300,000, and in addition authorized continuing contracts in the sum of $700,000 for prosecuting the improvement and for maintenance, in accordance with the plans of the Board of Engineers for Rivers and Harbors, as set forth in the House document just referred to. The recommendation of the Board was that the improvement should be undertaken in a tentative manner, with the object of first securing across the bar the maximum depth within the limits fixed by Congress that can be maintained by dredging alone, a 21-foot channel first to be dredged and then gradually deepened until the limit fixed by economy of maintenance is reached. The act authorized such raising and extending of dikes, jetties, and other contraction works as may be necessary at a cost not to exceed $300,000, and the purchase of a pumping dredge of the stationary type at a cost of $125,000. The increased depth gained upon the bar is to be carried up the river by dredging, if necessary, at such a rate as will insure the same navigable depth as is maintained on the bar.

Continuing contracts are authorized for work in this harbor, and $400,000 is yet to be appropriated under the authorization.

The amount expended under the 28-foot project up to June 30, 1907, was $1,643,282.29, of which $211,043.28 was for maintenance. The sum of $672.25 has been derived from sales of Government property and deposited to the credit of the appropriation.

The expenditures to June 30, 1908, under the tentative project adopted March 2, 1907, amounted to $327,250.60, of which $36,512.05 was for maintenance, and $112,701.64 was disbursed by Maj. J. C. Sanford, Corps of Engineers, on account of the construction of the dredge provided for by the project, and the sum of $8 was received by him from the sale of blueprints of the plans of the dredge. Details of dredge construction will be found in Appendix H 9.

The total amount expended for the improvement of Savannah Harbor up to June 30, 1908, was $8,018,563.31. A total of $36.90 was received from sales of condemned property. The expenditure of this sum has secured and maintained the various objects had in view in projects heretofore stated and with the net result of securing a navigable channel not less than 22 feet deep at mean low water from the wharves of Savannah to the sea.

Savannah Harbor is navigable from its mouth up to the Old Waterworks, 2 miles above the city—a distance of 22 miles.

During the past fiscal year operations have been carried on under the tentative project adopted March 2, 1907, and consisted in dredging on Tybee Knoll and the outer bar by United States seagoing dredges, and the repairing, raising, and extending of training walls and spur dams under contract.

Work done for maintenance during the fiscal year consisted in the removal of 370,762 cubic yards of material from the inner harbor by United States seagoing dredges, and the rehandling of 116,695 cubic yards of this amount by a hired pumping dredge, which cast the material ashore from the basin of deposit at the Venus Point mooring dolphin. In addition to this there has been dredged from the inside route, between Savannah, Ga., and Beaufort, S. C., a total of 31,154 cubic yards of material. This work was done under two allotments aggregating $9,000, made from the emergency appropriation provided for in the river and harbor act of March 3, 1905, and was designed to restore former conditions. Work was in progress at the end of the fiscal year, and the allotment will suffice to accomplish the purpose proposed.

At the close of the fiscal year the controlling depth from the upper end of the harbor to the sea was 28 feet at mean high water. The width of channel varies from 350 to 500 feet. On the ocean bar, where the real experiment is being made, there now exists a channel along the center line having a width of not less than 150 feet and a minimum depth of 32 feet at mean high water. The 31-foot channel is 225 feet wide and the 30-foot channel is 325 feet wide, and the depths diminish toward the side ranges to what existed there naturally. Thirty-three feet deep at mean high water for a width of 500 feet are the maximum limits allowed under the law. Comparative surveys indicate that the deposit in the cut is very small and that the maintenance of an adequate channel will not be difficult, but the work must be carried further before this can be absolutely proved.

The training walls are being raised to the level of high water at the points where large escape of water from the regulated channel took place, and a better control of the river channel is being secured, which will result in a reduced cost of maintenance and will facilitate the work of carrying the deep water gained on the bar up to the city.

For a distance of about 1,800 feet in the extreme upper end of the harbor a channel 400 feet wide and 28 feet deep at mean high water had been secured under the 28-foot project, but on June 30, 1908, the controlling depth was only 16 feet at mean low water (22 feet at mean high water), due to the washing down of sand from the shallow reaches above. Redredging for the purpose of maintenance can be deferred for a time, as this section of the harbor is not now needed for the use of large vessels.

The mean rise and fall of tide on the outer bar is 7 feet; on Tybee Knoll 6.8 feet, and from that point to the upper limits of the harbor it averages 6.4 feet.

It is proposed to expend the balance on hand and the additional appropriation recommended in carrying forward the tentative project, i. e., in widening and deepening the channel on the bar toward the limits of economical maintenance and in extending the increased depth gained up to the city.

The additional work proposed is for extension of benefits.

In 1872 the tonnage of vessels arriving and clearing at Savannah Harbor was reported to be somewhat more than 1,000,000 and the total value of imports and exports about $34,000,000. In 1890 the total tonnage was reported to have increased about 2,000,000 and the value of imports and exports to $152,000,000. For the calendar year 1907 the total amount of freight received and shipped at the port was 3,885,434 tons, valued at $209,018,494, an increase over the previous year of 84,385 tons. The commerce consists principally of naval stores, fertilizers, produce, iron, cotton, lumber, and general merchandise.

The effect of the improvement upon freight rates since 1896 has been a reduction of from 30 to 50 per cent, according to the nature of the commodity.

A list of Reports of the Chief of Engineers and executive documents, in which the various projects, examinations, surveys, maps, etc., are printed, may be found on page 272 of the Annual Report of the Chief of Engineers for 1905. A map of the harbor, showing conditions on June 30, 1906, will be found in the Annual Report of the Chief of Engineers for 1906, opposite page 1192.

Reference to report on resurvey of the harbor required by the river and harbor act of March 3, 1905, will be found on page 311 of the Annual Report of the Chief of Engineers for 1906.

July 1, 1907, balance unexpended		[a] $394,085.92
Amount received from sale of blueprints		[b] 8.00
Amount received from proceeds of sales of Government property		36.90
Amount allotted from emergency appropriation act of March 3, 1905		9,000.00
Amount appropriated by sundry civil act approved May 27, 1908		300,000.00
		703,130.82
June 30, 1908, amount expended during fiscal year:		
For works of improvement	[c] $260,566.88	
For maintenance of improvement	66,512.05	
		327,078.93
July 1, 1908, balance unexpended		[d] 376,051.89
July 1, 1908, outstanding liabilities		46,479.08
July 1, 1908, balance available		[e] 329,572.81
July 1, 1908, amount covered by uncompleted contracts		[f] 35,924.38
Amount (estimated) required for completion of existing project		400,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908		400,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(See Appendix O 1.)

2. Savannah River, below Augusta, Ga.—This river is navigable from Savannah to Augusta, Ga., a distance of 202 miles. Previous to improvement there were numerous shoals in the river, with less

[a] Includes $1,828.33 for construction of dredge.
[b] Received by officer in charge of construction of dredge.
[c] Includes $112,529.97 for construction of dredge.
[d] Includes $12,306.36 for construction of dredge.
[e] Includes $12,306.36 for construction of dredge.
[f] Includes $7,062 for construction of dredge.

than 3 feet at summer low water, the other obstructions consisting of overhanging trees, snags, and sunken logs. The aggregate length of river upon which there was less than 5 feet was about 9,800 feet, divided up into 10 shoals, and the controlling depth was about 2½ feet.

The original project, submitted December 22, 1880, provided for a 5-foot channel, 80 feet wide, by means of removal of snags, trees, sand bars, etc., and protection of banks, at a cost of $91,000.

Under this project there was expended, prior to operations under the existing project, $93,480.09.

The existing project, adopted in 1890, provides for the establishment of a navigable steamboat channel 5 feet deep at ordinary summer low water between the cities of Augusta and Savannah, to be accomplished by removing sand and gravel bars, regulating portions of the river, revetting caving banks, closing incipient cut-offs, and removing snags and logs from the channel, and overhanging trees from the banks of the stream.

The total estimated cost of this improvement, in round numbers, was $332,000, on the supposition that funds would be regularly and adequately supplied, besides $3,000 to $5,000 annually for maintenance.

Reference to reports on examination and survey made in compliance with act of March 2, 1907, will be found on page 346 of this report.

The amount expended upon the work under the existing project up to June 30, 1908, was $393,170.92 (of which $34,717.46 was for maintenance), which, added to the amount previously expended, gives a total expenditure for this work of $486,651.01.

A total of $655.77 has been received from sales of unserviceable property and deposited to the credit of the appropriation.

The work done under the present project has resulted in the removal of great numbers of snags and stumps from the river channel and the cutting of numerous overhanging trees on the banks. Sand bars have been removed by means of training dikes and shore protection at 11 localities. A great deal of work, however, remains to be done, principally in the upper 30 miles of the river, where there are sand shoals with only 3 feet of water over them. A great many snags also require removal.

All work done during the fiscal year was for maintenance and consisted of the following:

One thousand six hundred and ninety-eight snags and 237 stumps were removed from the channel and 3,811 overhanging trees and 66 logs cut on the banks of the stream. Forty feet of the upper spur dam at Sand Bar Ferry and 100 feet of a temporary dike at Tweedys bar was removed, this work being made necessary by the shifting of the channel due to fre-hets. A training wall at Tweedys bar was repaired and the depth over several sand bars was materially increased by the dragging of heavy anchors over them by the Government snag boat. Twenty-five feet of a projecting point of bank was blasted away. The snag boat *Tugaloo* was hauled out on marine railway and repaired.

The proportion of the approved project accomplished up to June 30, 1908, was about 75 per cent.

At the close of the fiscal year the project depth of 5 feet can be carried from Savannah to Augusta, except at two or three places

near Augusta, where the controlling depth at an ordinary stage of summer low water is 3 feet. The river very rarely goes below 3 feet and rises more than 30 feet in times of floods, frequently standing for long periods at several feet above summer low water. Existing training and shore protection dikes are in a generally fair condition, except in the case of those at Tweedys bar, some of which are in need of repair.

In the upper 30 miles of the river the banks in many places cave more or less with every high freshet, and the problem of obtaining and maintaining the project depth has been treated in full in the report of the survey above referred to.

It is proposed to apply the available balance and additional appropriation recommended toward keeping the channel cleared of snags and similar obstructions and in repairing existing training and shore protection dikes. The additional work proposed is for extension of benefits.

Prior to the improvement the commerce was small, but its quantity unknown. The total commerce of the river during the calendar year 1907 amounted to 63,013 tons, valued at $6,796,530. It consists principally of cotton and cotton-factory products, naval stores, fertilizers, and general merchandise. There was also rafted down the river during 1907 about 15,000,000 feet B. M. of timber, valued at about $150,000.

The effect of the improvement upon freight rates has been a reduction of from 30 to 50 per cent, according to the nature of the commodity.

A list of Reports of the Chief of Engineers and of executive documents, in which projects of improvement, maps, etc., are printed, may be found on pages 274 and 275 of the Annual Report of the Chief of Engineers for 1905.

July 1, 1907, balance unexpended	$29,384.12
June 30, 1908, amount expended during fiscal year for maintenance of improvement	11,879.36
July 1, 1908, balance unexpended	17,504.76
July 1, 1908, outstanding liabilities	1,037.89
July 1, 1908, balance available	16,466.87
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	54,000.00

(See Appendix O 2.)

3. Savannah River above Augusta, Ga.—This portion of the Savannah River is navigable only by pole boats from the locks, 7 miles above the city of Augusta, to Petersburg, a distance of 18 miles. In its original condition the river at low water was navigable only with great difficulty, on account of shallow water, obstructing logs, etc.

The original project of improvement, submitted February 8, 1879, provided for a 3-foot channel, 30 feet wide, from Augusta, Ga., to Trotters shoals, and the removal of snags, trees, etc., to the Tugaloo River, at a cost of $45,000.

Under this project there was expended, prior to operations under the existing *project, $39,000.*

The existing plan of improvement, adopted by Congress July 13, 1892, provides for the establishment, between Petersburg and the locks, of a downstream channel 12 to 25 feet in width and navigable during ordinary summer low water for pole boats drawing 2 feet, and of an upstream channel navigable for pole boats drawing 1.3 feet of water. This is to be obtained by removing logs and overhanging trees; excavating rock, sand, or gravel, and with excavated materials raising crests of ledges; constructing training walls, to increase flow of water through sluices. The total estimated cost is $33,000.

The total amount expended under the present project up to June 30, 1908, was $22,289.17, which, added to that previously expended, gives a total for this work of $61,289.17. No funds have been expended for maintenance.

The work accomplished under this project has given a downstream channel about 2 feet deep and an upstream channel of the project depth. In many places, however, these channels are difficult to navigate and are capable of greater improvement.

The proportion of the approved project accomplished up to June 30, 1908, was about 55 per cent.

The work of the year consisted in removal of bowlders and ledge rock and the construction of a small dam at Big Rapid Gap.

It is proposed to apply the available balance and the additional appropriation recommended toward the removal of obstructions and the widening and deepening of the channel.

The additional work proposed is for extension of benefits.

In 1876–77 about 2,000 tons of freight went upstream and about 12,000 bales of cotton came down. In 1907 the total freight carried on this portion of Savannah River amounted to 3,983 tons, valued at $122,028. The commerce consists of cotton, grain, fertilizers, hay, cord wood, and general merchandise, and is carried on exclusively by pole boats.

The effect of the improvement has been to render navigation safer and easier, but it is impossible to determine whether it has caused any reduction in freight rates.

A list of Reports of the Chief of Engineers and of executive documents containing the projects of improvement, maps, etc., may be found on page 276 of the Annual Report of the Chief of Engineers for 1905.

July 1, 1907, balance unexpended	$3,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	289.17
July 1, 1908, balance unexpended	2,710.83
Amount (estimated) required for completion of existing project	8,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	3,000.00

(See Appendix O 3.)

4. Harbor at Darien, and Doboy bar, Georgia.—(*a*) *Darien Harbor.*—This harbor is navigable from its mouth to the town of Darien, a distance of 13 miles.

In its original condition it was obstructed at seven points by shoals, with mean low-water depths of from 6½ to 10½ feet. Between the shoals there was nowhere less than 12 feet at mean low water.

There was expended on this harbor in 1879 for dredging $8,000, without any project having been recommended or adopted.

The project for the improvement of this harbor, adopted in 1885, contemplates the establishment of a navigable channel 12 feet deep at mean low water between Darien and Doboy at an estimated cost of $170,000. Work was not begun under this project until 1891. The total amount expended under it up to June 30, 1908, was $157,366.65 (of which $20,572.75 was for maintenance), which, added to the amount previously expended, gives a total for this work of $165,366.65. The work done under the present project has resulted in a navigable channel 12 feet deep at mean low water from Darien to Doboy. The project was reported as completed July 11, 1905.

The sum of 69 cents, refundment, was received and deposited to the credit of the appropriation.

No work was done during the fiscal year, no funds being available.

On June 30, 1908, the controlling depth in the harbor was 10.5 feet at mean low water, shoaling having occurred at two or three places since the project depth of 12 feet was obtained in July, 1905. The mean rise and fall of tide is from 6.5 feet at Darien to 7 feet at the entrance.

The additional work proposed is for maintenance only.

The total tonnage for 1878 was estimated at about 200,000 and the value of exports at between $600,000 and $700,000. The commerce consists almost entirely of timber, and in 1907 the total shipments amounted to 71,041,956 feet, valued at $1,022,612. In addition there was 76,000,000 feet rafted through the harbor to Sapelo and to Savannah. The local freight handled at the port during 1907 amounted to 1,500 tons, valued at $75,000.

The improvement of this harbor has rendered it possible to ship lumber from Darien, which before was impracticable, and has caused a reduction in freight rates of about 15 per cent.

A list of the Reports of the Chief of Engineers in which the project of improvement, history of the work, etc., are printed may be found on page 277 of the Annual Report of the Chief of Engineers for 1905.

By act of Congress approved June 13, 1902, this work was consolidated with Doboy bar, Georgia.

Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement	$10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*b*) *Doboy bar.*—In 1888, $5,795.40 was spent in harrowing and water-jet work on this bar without result. In its original condition there was about 12 feet at mean low water in the old channel, which was very crooked, so that the entrance was not much used.

The project for its improvement, adopted by act of Congress of March 3, 1899, provides for creating a channel by dredging 24 feet deep at mean high water and 300 feet wide, estimated to cost $70,000. The proposed channel is some distance north of the old channel.

The amount expended under the project up to June 30, 1908, was $49,134.14, which, added to the amount previously expended, gives

a total expenditure for this work of $54,929.54. No funds have been expended for maintenance.

The sum of 10 cents, refundment, was received and deposited to the credit of the appropriation.

By act of Congress approved June 13, 1902, this work was consolidated with Darien Harbor.

No work was done during the fiscal year.

The work which has been done under the existing project secured a channel across the bar 150 feet in width, with a controlling depth of 12 feet at mean low water, but this channel was never marked or used and has probably filled in to the extent of the surrounding depth on the bar.

The mean rise and fall of tide on the bar is 7 feet.

Practically no advancement has been made toward the completion of the approved project, and it is quite doubtful if the desired improvement at this bar can be effected by dredging alone, except at great cost. None of the channels across the bar appear to have any stability. Extensive sand shoals lie to the north and south of the entrance to the sound, and the material comprising them is easily transported by the littoral currents, which are very strong in this vicinity under the influence of northeast or southeast winds. The approved project calls for a channel 24 feet deep at mean high water (17 feet at mean low water), while a channel only 12 feet at mean low water has been dredged. This latter depth, however, corresponds with the project depth for Darien Harbor, and it would appear that the maintenance of a channel of this depth across the bar would be sufficient to meet the demands of the present commerce.

No additional work is proposed and no appropriation is recommended.

The commerce interested in this bar consists of lumber received from the Altamaha River and its tributaries, the bulk of which is now shipped from Sapelo Sound and St. Simons Sound, north and south, respectively, of Doboy bar. During the calendar year 1907 3,908,415 feet of lumber, valued at $95,700, crossed the bar.

A list of the Reports of the Chief of Engineers and of executive documents in which projects, maps, and history of the work are printed, may be found on page 278 of the Annual Report of the Chief of Engineers for 1905.

(See Appendix O 4.)

5. Altamaha, Oconee, and Ocmulgee rivers, Georgia.—These three improvements were consolidated by the river and harbor act of March 2, 1907.

(*a*) *Altamaha River, Georgia.*—This river is formed by the junction of the Oconee and Ocmulgee rivers. At a point some 25 miles from its mouth the river branches, and the river traffic reaches the ocean by two routes—one by the north branch by way of Darien, and the other by the south branch to where it intercepts the inside waterway, which passage is taken to Brunswick.

Before improvement the Altamaha River was obstructed by rock ledges, sand bars, snags, sunken logs, and overhanging trees. The low-water depths at some points did not exceed 1 foot.

The original project of improvement, submitted in 1875, contemplated a channel 4 feet deep and 80 feet wide from Macon to Darien

by the removal of sand bars, rock shoals, snags, overhanging trees, etc., at a cost of $162,000.

Under it and its modifications there was expended up to June [illegible], 1890, $69,776.59.

The existing project of improvement, adopted by Congress in [illegible], provides for the establishment of a channel 3 feet deep at summer low water throughout the river above Darien. This is to be accomplished by removing rock shoals and sand bars, building deflecting dikes, and closing incipient cut-offs, removing snags and sunken logs from the channel and overhanging trees from the banks of the stream, and revetting caving banks. The total estimated cost of the improvement is $129,000, provided funds are regularly and adequately supplied, besides from $3,000 to $5,000 for annual maintenance.

The amount expended on the work under the present project [illegible] June 30, 1908, was $91,695.59 (of which $16,028.61 was for [illegible] tenance), which, added to the amount previously expended, gives a total expenditure for this work of $161,472.18.

A total of $111.50 has been received from proceeds of [illegible] serviceable property and deposited to the credit of the appropriation.

This expenditure has resulted in the removal of two rock [illegible] five sand bars, numerous snags, sunken logs, stumps, [illegible] ing trees, and the straightening of the river at several points [illegible] offs.

The river is navigable from the forks to Darien, a [illegible] miles, and to where it reaches the inside waterway. The [illegible] of the river is affected by the tides. The worst shoal [illegible] bar, which at low water has only about 2½ feet of water, [illegible] ing on tides 5 feet can be had at this place. The [illegible] above the tidal range is about 2½ feet at summer low [illegible] river is subject to freshets, and in the upper [illegible] height at times goes 20 feet above the low summer stage. The [illegible] section is bordered by low swamp lands, and the freshets [illegible] to 10 feet over the banks.

The work done for maintenance during the fiscal year [illegible] the removal of snags, stumps, and bowlder rock from [illegible] overhanging trees and logs from the banks, and [illegible] Bluff Cut-off. Repairs were made to the [illegible] hull for the snagboat *Ocoee* was constructed.

The proportion of the approved project accomplished [illegible] 30, 1908, was about 75 per cent.

It is proposed to apply the available balance [illegible] appropriation recommended in removing snags [illegible] hanging trees, in removing sand bars and [illegible] ing old works of improvement.

The additional work proposed is for [illegible]

The commerce of the river before the improvement [illegible] reported to have amounted to about [illegible] about $1,000,000. During [illegible] tons, valued at $345,000. [illegible] ing the same period [illegible] 590,000.

As nearly [illegible] been to cau[illegible]

A list of Annual Reports of the Chief of Engineers and of executive documents containing projects of improvement, history of the work, maps, etc., may be found on page 279 of the Annual Report of the Chief of Engineers for 1905.

July 1, 1907, balance unexpended		$19,826.15
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$3,143.32	
For maintenance of improvement	6,043.51	
		9,186.83
July 1, 1908, balance unexpended		10,639.32
Amount (estimated) required for completion of existing project		103,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

(*b*) *Oconee River, Georgia.*—The head of navigation on this river is Milledgeville, Ga., 147 miles from the mouth, though at present this point can only be reached during high stages of the river.

The river is navigable also for a distance of 17 miles between the Georgia Railroad bridge (54 miles above Milledgeville) and the northern boundary of Greene County. Between Milledgeville and the Georgia Railroad bridge, above, the river is obstructed by obstacles, both natural and artificial, and is incapable of improvement except by an expensive system of locks and dams. At ordinary stages the river is at present only navigable to a point about 25 miles above Dublin, Ga., a distance of 104 miles from its mouth. In its original condition this river was used principally for navigation at high stages. At low water there were numerous shoals and snags, there probably being less than 2 feet on many sand bars and rock ledges.

The original project was submitted January 29, 1875, and provided for the removal of snags, overhanging trees, etc., cutting off points, and making cut-offs, at a cost of $10,150.

Under this project and its modifications there was expended, previous to the commencement of operations under the existing project, the sum of $44,822.18.

The existing project of improvement was adopted by Congress September 19, 1890. It provides for the establishment of a navigable channel 3 feet deep at ordinary summer low water from Milledgeville to the mouth. This is to be accomplished by removing rock shoals and sand bars, revetting caving banks, and closing incipient cut-offs, removing snags and logs from the channel and overhanging trees from the banks of the stream. The cost of the improvement is estimated at $171,000, besides from $3,000 to $5,000 for annual maintenance. The river and harbor act of March 3, 1905, authorized the expenditure of $3,000 of the amount appropriated to be applied to cleaning out the river from the Georgia Railroad bridge to the northern boundary of Greene County, Ga., thus bringing this short section under improvement.

The amount expended under the present project up to June 30, 1908, was $140,931.58 (of which $11,454.28 was for maintenance),

[a] See consolidated money statement on page 338.

which, added to the amount previously expended, gives a total expenditure for this work of $185,753.76.

A total of $648.77 has been received from sales of unserviceable property and 50 cents from refundment, which was deposited to the credit of the appropriation.

As a result of this expenditure numerous snags and logs, bowlders, and overhanging trees have been removed, several cut-offs opened and others closed, five training dikes and one spur dam built, and four rock shoals and several sand shoals removed below Milledgeville. Between the Georgia Railroad bridge, above Milledgeville, and the northern boundary of Greene County the most troublesome obstructions have been removed from the channel and numerous overhanging trees and logs cut on the banks.

Work done for maintenance during the fiscal year consisted in the removal of snags, stumps, and rock from the channel, and overhanging trees and logs from the banks. A spur dam was constructed at Fish Trap shoals. The old training wall at Bonny Clabber was extended and a spur dam was constructed at this point. Repairs were made to floating plant.

On June 30 the controlling depth at ordinary summer low water between the forks and Dublin was 3 feet; between Dublin and the Central of Georgia Railway bridge, 25 miles above, 2.5 feet, and between the latter point and Milledgeville, 1.5 feet. From the Georgia Railroad bridge, above Milledgeville, to the northern boundary of Greene County, the controlling depth was 2.5 feet. This river occasionally falls below these depths and frequently rises to 20 feet above them.

The proportion of the approved project accomplished up to June 30, 1908, was about 75 per cent.

It is proposed to apply the available balance and additional appropriation recommended toward the removal of snags and stumps from the channel and the cutting of overhanging trees from the forks to Milledgeville; the removal of rock and sand shoals between the forks and the Central of Georgia Railway bridge, 25 miles above Dublin; in making such repairs to existing dikes as may become necessary, and in closing incipient cut-offs and opening others wherever found advisable. No additional work above Milledgeville is proposed.

The additional work proposed is for extension of benefits between the forks and the Central of Georgia Railway bridge above Dublin; between the Central of Georgia Railway bridge (above Dublin) and Milledgeville the additional work proposed is necessary to make the improvement available.

No reliable statistics of the commerce of the river before the improvement was begun are available. During the calendar year 1907 the amount of freight carried on the river between the forks and Milledgeville amounted to 11,000 tons, valued at $330,000. There was also rafted on this portion of the river during 1907, 51,800,000 feet B. M. of timber, valued at about $848,000. During the same period there was carried over that portion of the river between the Georgia Railway bridge (54 miles above Milledgeville) and the northern boundary of Greene County 900 tons of freight, valued at $27,000.

As nearly as can be determined, the effect of the improvement has been to cause a reduction of from 25 to 40 per cent in freight rates.

A list of the Annual Reports of the Chief of Engineers and of executive documents containing the various projects, maps, history of the work, etc., may be found printed on pages 280 and 281 of the Annual Report of the Chief of Engineers for 1905.

July 1, 1907, balance unexpended		$29,052.81
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$10,244.38	
For maintenance of improvement	6,162.92	
		16,407.30
July 1, 1908, balance unexpended		12,645.51
July 1, 1908, outstanding liabilities		1,645.46
July 1, 1908, balance available		11,000.05
Amount (estimated) required for completion of existing project		98,842.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

(c) *Ocmulgee River, Georgia.*—In its original condition this river was used for navigation chiefly at high stages. At low water there were numerous shoals and snags, there probably being less than 2 feet on many sand bars and rock ledges.

The head of navigation on this river is Macon, a distance of 202 miles from the forks.

The original project was submitted in 1875 and provided for a channel 80 feet wide and 4 feet deep at low water, to be accomplished by the removal of sand bars, rock shoals, snags, overhanging trees, etc., from Macon to Darien, at a cost of $162,000.

The amount expended under this project and its modifications prior to operations under the existing project was $79,390.73.

The existing project of improvement, adopted by Congress September 19, 1890, provides for the establishment of a navigable channel 3 feet deep at ordinary summer low water from Macon to the river's mouth. This is to be obtained by removing rock shoals and sand bars, closing incipient cut-offs, revetting caving banks, and removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement as given in the project of 1890 is estimated at $210,000, provided funds are regularly and adequately provided, besides from $3,000 to $5,000 for annual maintenance.

The amount expended under the present project up to June 30, 1908, was $258,452.63 (of which $20,132.08 was for maintenance), which, added to the amount previously expended, gives a total of $337,843.36.

A total of $802.26, received from sales of unserviceable property, and $20.45, refundments, have been received and deposited to the credit of the appropriation.

The work under the present project has resulted in a navigable channel from the forks to Macon. A great deal of work, however, remains to be done between Hawkinsville and Macon.

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[a] See consolidated money statement on page 338.

Work for maintenance during the fiscal year consisted in the removal of snags and stumps from the channel, the cutting of overhanging trees, saplings, and logs on the banks, and the girdling of trees. Repairs were made to floating plant.

On June 30 the controlling depth between the forks and Macon was about 2½ feet at ordinary summer low water at Tillman's bar, 5 miles above the forks; elsewhere the controlling depth was practically 3 feet. The river occasionally falls a foot below the ordinary summer stage and frequently rises 20 feet above.

The proportion of the approved project accomplished up to June 30, 1907, was about 90 per cent.

It is proposed to apply the available balance and additional appropriation recommended in the removal of logs, snags, stumps, and overhanging trees, in the removal of rock and sand shoals, maintaining existing training dikes and shore protections, and in closing incipient cut-offs and opening others wherever deemed advisable.

The additional work proposed is for extension of benefits.

No reliable statistics of the commerce of the river before improvement was begun are available. In 1907 the freight carried on the river amounted to 10,996 tons, valued at about $600,000. Besides this, 35,662,000 feet B. M. of timber was rafted down the river, valued at about $509,400. For several years past there has been no navigation at all between Hawkinsville and Macon, except that one small steamer made occasional trips to Macon. A company has been formed at Macon for the purpose of operating a line of steamers between that point and Brunswick, and at this time has two steamers making regular trips between these two cities.

As nearly as can be determined, the effect of the improvement has been to cause a reduction of from 25 to 40 per cent in freight rates. A list of the Annual Reports of the Chief of Engineers and of executive documents containing the various projects, history of the work, maps, etc., may be found printed on page 282 of the Annual Report of the Chief of Engineers for 1905.

Reference to report on examination of the river ordered by the river and harbor act of March 3, 1905, will be found on page 311 of the Annual Report of the Chief of Engineers for 1906.

July 1, 1907, balance unexpended		$29,571.74
Amount received from proceeds of sales of Government property		62.50
		29,634.24
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$9,943.62	
For maintenance of improvement	2,211.27	
		12,154.89
July 1, 1908, balance unexpended		17,479.35
July 1, 1908, outstanding liabilities		1,228.58
July 1, 1908, balance available		16,250.77
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

[a] See consolidated money statement on page 338.

CONSOLIDATED.

July 1, 1907, balance unexpended		$78,450.70
Amount received from proceeds of sales of Government property		62.50
		78,513.20
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$23,331.32	
For maintenance of improvement	14,417.70	
		37,749.02
July 1, 1908, balance unexpended		40,764.18
July 1, 1908, outstanding liabilities		2,874.04
July 1, 1908, balance available		37,890.14
Amount (estimated) required for completion of existing project		201,842.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		88,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix O 5.)

6. *Club and Plantation creeks, Georgia.*—A project for dredging a canal 7 feet deep at mean low water, with a bottom width of 50 feet, to connect these two creeks and thus provide an inside route between the Altamaha River and its tributaries and Brunswick Harbor for use of light-draft river boats and timber rafts, will be found printed as House Document No. 159, Fifty-eighth Congress, second session. Besides the dredging of the canal, the project provides for the straightening of Plantation Creek and for dredging in both Club and Plantation creeks, where necessary to give a channel 7 feet deep at mean low water. The estimated cost of the work is $10,700. This project was adopted by act of Congress approved March 2, 1907, which appropriated $20,000 toward its completion.

No work has yet been done. Portions of the route cross marsh land owned by private individuals and the city of Brunswick, Ga., and no provision was made in the act for the purchase of a right of way. A quit-claim deed has been secured from the city of Brunswick for that portion of the desired right of way owned by it. The balance of the land needed to complete the right of way is owned by several nonresident heirs at law, and a written permission has been obtained from their attorneys giving the United States the right to dredge and maintain the desired cut through their land. These papers have been referred to the Department of Justice for an opinion as to the sufficiency of title which they convey. If either of these grants are found inadequate, condemnation proceedings will be necessary.

It is proposed to apply the available balance toward the construction of the work as soon as a valid right of way is obtained, pending which no further appropriation will be asked for.

Reports of examination and survey are printed on page 1669 of the Annual Report of the Chief of Engineers for 1904.

July 1, 1907, balance unexpended	$20,000.00
July 1, 1908, balance unexpended	20,000.00
Amount (estimated) required for completion of existing project	20,700.00

(See Appendix O 6.)

7. Brunswick Harbor, Georgia.—Previous to June 13, 1902, the appropriations for the improvement under the Engineer Department were for the inner harbor only, consisting principally of the removal of a shoal in East River, opposite the lower part of the city. The act of Congress approved June 13, 1902, provided also for the improvement of the bar, which work had theretofore been carried on by direct contract between Congress and a private individual.

The harbor is navigable from the city of Brunswick to deep water beyond the bar, a distance of 13 miles, and also for 1 mile up Academy Creek, and up Turtle River to the Southern Railway wharves.

The original project of improvement, dated April 29, 1876, provided for the construction of a jetty at the city front and dredging, at a total cost of $69,000.

Under this project and its modifications there was expended, prior to operations under the existing project, the sum of $190,000.

The project in force up to June 13, 1902, was adopted by Congress in 1894. It provided for the maintenance of a navigable channel 15 feet deep at mean low water by keeping the existing works in repair and by dredging. The act of June 3, 1896, provided for the improvement of Academy Creek. The cost of maintaining a channel depth of 15 feet at mean low water was estimated at $15,000 per annum.

There had been expended under this project up to June 30, 1902, $34,817.25, all of which had been for maintenance.

Including $10,000 spent in 1836 for dredging, the total amount expended up to June 30, 1902, on the inner harbor was $234,817.25.

The act of Congress approved June 13, 1902, adopted a project providing for a navigable channel 21 feet deep at mean low water in Brunswick inner harbor, at a cost of $120,000, and for a channel across the outer bar 19.3 feet deep at mean low water (26 feet at mean high water), at a cost of $40,000. It also provided for dredging in Academy Creek at not to exceed $5,000. This project was completed in July, 1905, and expenditures since have been for maintenance.

The river and harbor act of March 3, 1905, authorized the expenditure from the amount therein appropriated of $5,000, or so much thereof as might be necessary, for maintaining in Academy Creek, immediately in front of and adjacent to the wharves thereof, to the Old Altamaha Canal a depth equal to the controlling depth on the shoals at the lower end of the city in East River, provided that no money should be expended inside harbor lines theretofore or thereafter established in said creek. With these funds a channel was dredged with a depth of 18.5 feet at mean low water and a width ranging from 50 to 90 feet.

The amount expended to June 30, 1907, under the project approved June 13, 1902, was $193,062.15, of which $19,596.82 was for maintenance. This, added to the amount previously expended, gives a total expenditure for the work up to June 30, 1907, of $427,879.40.

A refundment of 15 cents was received and deposited to the credit of the appropriation.

The result of this expenditure has been the accomplishment of a navigable channel throughout the inner harbor 21 feet deep at mean low water and of a channel across the outer bar 19.3 feet deep at mean low water (both 26 feet at mean high water); also of a narrow channel in Academy Creek above mentioned.

A new project was adopted by the act of Congress approved March 2, 1907. This project will be found printed as House Document No. 407, Fifty-ninth Congress, first session. It provides for creating and maintaining throughout the inner harbor (embracing Turtle River from the Southern Railway docks to its junction with Brunswick River, Academy Creek from Aiken's wharf to its junction with East River) and the outer harbor (embracing the outer bar, the navigable channel throughout the entrance to St. Simons Sound, and up Brunswick River to Brunswick Point), channels having a depth of 30 feet at mean high water, with widths varying from 150 feet in Academy Creek to 400 feet across the outer bar, to be accomplished mainly by dredging; but the extension of the existing training wall in East River and the construction of two spur dikes is also authorized. The estimated cost of the work is $496,650, with a yearly cost of maintenance not exceeding $33,250.

Congress in adopting this project appropriated the sum of $146,650 for the work and authorized contracts covering labor and materials necessary for its completion at a cost not to exceed $350,000 additional, of which $47,000 remains to be appropriated.

The amount expended under the present project up to June 30, 1908, was $109,077.75, and resulted in obtaining the project depth and width of channel in Academy Creek, in partially carrying out the project in East River, Turtle River, and opposite Brunswick Point, and in increasing the general depth on the bar by about 2 feet from the inner end of the channel to the bell buoy, a distance of 3 miles.

The total amount expended for the improvement of Brunswick Harbor up to June 30, 1908, was $536,957.15.

The proportion of the present project accomplished to June 30, 1908, was about 22 per cent, at which time the work was being carried forward under contract and satisfactory progress was being made.

On June 30, 1908, the controlling depth on the shoal in Brunswick River, opposite Brunswick Point, was 27 feet at mean high water. In East River the controlling depth was 27 feet, in Academy Creek 30 feet, in Turtle River 25.5 feet, and in the channel across the outer bar 26 feet. The mean rise and fall of tide on the bar is 6.6 feet, at Brunswick Point 7 feet, and at the city of Brunswick 7.4 feet.

It is proposed to apply the available balance and additional appropriation recommended in carrying out the approved project. The additional work proposed is for extension of benefits.

Before improvement in 1880 the annual commerce of Brunswick Harbor amounted to about 100,000 tons, valued at $1,700,000. The total commerce of the port for the calendar year 1907 amounted to 1,500,000 tons of freight, valued at $45,091,756. The commerce consists principally of cotton, lumber, cross-ties, naval stores, and general merchandise.

The effect of the improvement has been to cause a reduction of ocean-going freight rates on lumber of 25 per cent and on naval stores of 30 per cent.

A list of the Annual Reports of the Chief of Engineers and of executive documents containing the various projects, maps, history of the work, etc., may be found printed on page 284 of the Annual Report of the Chief of Engineers for 1905.

Reference to report on survey of Brunswick Harbor, inner and outer, provided for by the river and harbor act of March 3, 1905,

will be found on page 312 of Annual Report of the Chief of Engineers for 1906.

Pursuant to a requirement in the river and harbor act of March 2, 1907, an investigation has been made relative to the control and use of wharfage privileges at Brunswick Harbor, and report thereon was duly transmitted to Congress and printed in House Document No. 326, Sixtieth Congress, first session.

July 1, 1907, balance unexpended	$158,770.75
Amount appropriated by sundry civil act, approved May 27, 1908	303,000.00
	461,770.75
June 30, 1908, amount expended during fiscal year for works of improvement	109,077.75
July 1, 1908, balance unexpended	352,693.00
July 1, 1908, outstanding liabilities	41,162.26
July 1, 1908, balance available	311,530.74
July 1, 1908, amount covered by uncompleted contracts	325,031.73
Amount (estimated) required for completion of existing project	47,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	47,000.00

(See Appendix O 7.)

8. Inside water route between Savannah, Ga., and Fernandina, Fla.—This route consists of a series of bays and tidal sloughs, making a connecting waterway not exposed to rough water except at a few points in stormy weather. The waters forming the route are shown on Coast Survey charts Nos. 156 and 157. It is navigable from Savannah, Ga., to Fernandina, Fla., Brunswick, Ga., and Darien, Ga. The distance from Savannah to Fernandina is 160 miles. Touching at Darien en route increases this by about 20 miles and at Brunswick by about 12 miles.

The project of improvement was adopted in 1892 and provides for the establishment of a channel 7 feet deep at mean low water. This is to be accomplished by the improvement of Romerly Marsh, Mud River, Little Mud River, and Jekyl Creek. The estimated cost of the improvement was $105,000, provided the entire sum be made available at one time.

The total amount expended under this project up to June 30, 1908, was $110,521.80 (of which $46,011.86 was for maintenance), which, added to the amount expended for Jekyl Creek and Romerly Marsh, $71,108.77, makes a total of $181,630.57.

The river and harbor act of March 2, 1907, appropriated the sum of $30,000 for continuing the improvement and for maintenance, and authorized a resurvey to be made to determine the best route of said waterway for further improvement. This survey has been made, but report thereof had not been submitted by the district officer at the close of the fiscal year.

Work for maintenance during the fiscal year consisted in the placing of 2,245.9 bushels of oyster shells on the training wall in Jekyl Creek.

The proportion of the approved project accomplished up to June 30, 1908, was about 80 per cent.

On June 30, 1908, the controlling depth between Savannah and the mouth of Vernon River was 2 feet, at mean low water, in Parsons Cut, and between the mouth of Vernon River and Fernandina it was 5½ feet, at mean low water, in the Florida Passage. By way of the new route through Skidaway Narrows (now under improvement) the controlling depth between Savannah and the mouth of Vernon River was 3 feet, at mean low water. By waiting on the tides, however, at Parsons Cut or at Skidaway Narrows, a navigation in excess of 7 feet could be carried from Savannah to Fernandina.

The mean rise and fall of the tide varies at different localities from 6.5 feet to 8 feet.

It is proposed to apply the available balance and additional appropriation recommended toward securing and maintaining a 7-foot navigation, at mean low water, throughout the entire route.

The additional work proposed is for extension of benefits.

The value of the commerce passing over this route was estimated in 1890 at between $200,000 and $300,000 per annum. During the calendar year 1907 the commerce amounted to 151,670 tons of freight, valued at $3,134,000. There was also rafted on this route during 1907 81,980,000 feet B. M. of timber valued at $1,335,000. Little, if any, of this commerce passed over the whole extent of the route.

It is impracticable to determine the effect of this improvement upon freight rates, as at present the different portions of the route are used locally, and comparatively few vessels engaged in commerce pass over the entire length of it.

A list of the Annual Reports of the Chief of Engineers and of executive documents containing the various projects, maps, history of the work, etc., may be found printed in the Annual Report of the Chief of Engineers for 1905, page 285.

July 1, 1907, balance unexpended		$30,478.93
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$5,950.08	
For maintenance of improvement	50.65	
		6,000.73
July 1, 1908, balance unexpended		24,478.20
July 1, 1908, outstanding liabilities		2,193.75
July 1, 1908, balance available		22,284.45
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		41,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix O 8.)

9. Skidaway Narrows, Georgia.—The Narrows is a narrow, tortuous water course, and when improved will constitute an alternative or additional route for a portion of the inside waterway between Savannah, Ga., and Fernandina, Fla. In its present condition it is navigable only at high water for small sailboats and pleasure launches.

The approved project of improvement was adopted by the river and harbor act of March 3, 1905, and will be found printed in the Annual Report of the Chief of Engineers for 1904, pages 1680–1684.

This project contemplated the establishment of a navigable channel 6 feet deep at mean low water and 75 feet wide at bottom, connecting Burnside River with Isle of Hope (or Skidaway) River, the route of such channel to be through the marsh and hammock land to the west of the Narrows. Subsequent developments made it necessary to abandon this route—principally on account of the difficulty in obtaining the desired right of way through private property. A new route, following practically the course of the Narrows, has been adopted. The estimated cost of the improvement by the new route is $55,000.

The amount expended up to June 30, 1908, was $34,595.19.

With the $20,000 appropriated by the river and harbor act of March 3, 1905, a channel with a bottom width of 60 feet and a depth of 5 feet at mean low water was provided over a portion of the adopted route, making it available for commerce at high water.

With the $35,000 appropriated by the river and harbor act of March 2, 1907, this channel is to be deepened to not less than 6 feet at mean low water and widened to 75 feet, and a channel of equal proportions dredged along the remainder of the route.

Dredging operations were begun October 12, 1907, and were in progress at the close of the fiscal year.

While the work already done renders navigation through the Narrows much easier at high water, the route will not be available at low water until the additional dredging mentioned above is completed.

The mean rise and fall of tide at this locality is 8 feet.

The proportion of the approved project accomplished up to June 30, 1908, was about 65 per cent.

It is proposed to expend the available balance in completing the improvement.

Although the improvement is far from complete, this route, which is about 6 miles shorter from Savannah to the south than the old route, is extensively used, but it is not practicable to separate its commerce from that of the inside route, of which it forms a part.

This improvement has not yet been carried far enough to produce any material reduction in freight rates.

July 1, 1907, balance unexpended	$34,432.85
June 30, 1908, amount expended during fiscal year for works of improvement	14,028.04
July 1, 1908, balance unexpended	20,404.81
July 1, 1908, outstanding liabilities	4,197.60
July 1, 1908, balance available	16,207.21
July 1, 1908, amount covered by uncompleted contracts	15,973.54

(See Appendix O 9.)

10. Cumberland Sound, Georgia and Florida.—In its original condition the available depth at the entrance varied from 11 to 12.5 feet at mean low water. The point of crossing the bar was subject to very great changes in location, moving in a series of years as much as 1½ miles. The distance from the outer bar to the city of Fernandina, Fla., is about 6½ miles.

The project of improvement submitted in 1879 and revised by a Board of Engineers in 1891 provides for the construction of two low jetties from the shores on opposite sides of the entrance and extending seaward across the bar upon lines so directed that the ends will

be parallel to each other and about 3,900 feet apart. These jetties were intended to establish a low-water channel across the bar not less than 19 feet in depth. The cost of the improvement was originally estimated at $2,071,023, and as modified at $1,606,500, for the completion of low jetties, and at $2,079,500 if high jetties were found necessary. There was expended under this project $932,500.

The present project, which was adopted by act of Congress of June 3, 1896, provides for the establishment of a channel across the bar 19 feet deep at mean low water by the construction of two jetties of stone, resting on a foundation of brush mattresses, on the same line as those in the previous project, the scour between the jetties to be aided by dredging, if necessary, the total cost of the improvement, at the time of this project, to be $2,350,000, exclusive of amounts previously appropriated.

The amount expended under this project up to June 30, 1908, was $2,358,022.89 (of which $254,194.36 was for maintenance), which, added to the amount previously expended, gives a total expenditure for this work of $3,290,522.89.

A refundment of $3,944.13 and a total of $8.90 received from sale of unserviceable property have been received and deposited to the credit of the appropriation.

By this expenditure two stone jetties have been constructed and a seagoing dredge provided, which together have produced a navigable channel with a minimum width of 400 feet and a controlling depth of 24.5 feet at mean low water, or 5.5 feet more than called for by the project.

All work done during the fiscal year was for maintenance, and consisted of the following:

The United States seagoing dredge *Cumberland* removed a total of 186,981 cubic yards of material in straightening and deepening the channel alongside the north jetty. A cross-section survey was made of the outer end of the south jetty and a complete survey made of the entrance between the jetties and the outer bar. Four miles of high-water line on the south end of Cumberland Island was located and plotted. Ranges were established marking the channel along the north jetty. Specifications were issued and contract entered into for repairing the south jetty.

On June 30, 1908, the ship channel alongside the north jetty had a controlling depth of 24.5 feet at mean low water, with a general depth of 25 feet. The channel has a minimum width of 400 feet and is upon a straight line defined by ranges on Amelia Island.

The channel on the south side of the entrance has continued to deepen and enlarge during the past year and on June 30, 1908, had a controlling depth of 22 feet at mean low water.

The mean rise and fall of tide is 6 feet.

The project for the improvement of Cumberland Sound was reported as completed in the Annual Report of the Chief of Engineers for 1905, page 1287.

It is proposed to apply the available balance and additional appropriation recommended toward raising the low places in the north and south jetties to high-water mark, filling voids and openings in the north jetty, and constructing mounds at the outer ends of both jetties, and for such repairs to the dike on Cumberland Island and such dredging in the jetty channel as may become necessary.

The additional work proposed is for extension of benefits.

As Cumberland Sound merely constitutes the ocean entrance to Fernandina Harbor the commerce is practically the same as that for Fernandina, and since the harbor of Fernandina is now a special work of improvement the commerce is given under that head.

The effect of the improvement has been to cause a reduction in freight rates of from 25 to 40 per cent.

A list of the Annual Reports of the Chief of Engineers and of executive documents containing the various projects, history of the work, maps, etc., may be found printed on page 288 of the Annual Report of the Chief of Engineers for 1905.

Reference to reports on examination and survey of Fernandina Harbor, ordered by the river and harbor act of March 3, 1905, will be found on page 312 of the Annual Report of the Chief of Engineers for 1906.

July 1, 1907, balance unexpended	$117,201.46
Amount received from refundment	2.00
	117,203.46
June 30, 1908, amount expended during fiscal year for maintenance of improvement	16,273.32
July 1, 1908, balance unexpended	100,930.14
July 1, 1908, outstanding liabilities	201.77
July 1, 1908, balance available	100,728.37
July 1, 1908, amount covered by uncompleted contracts	74,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	50,000.00

(See Appendix O 10.)

11. Fernandina Harbor, Florida.—As will be seen from Coast Survey chart No. 453, the lower end of Amelia River forms a deep basin opposite the city of Fernandina, which portion of the river is known as Fernandina Harbor. The lower end of the harbor connects with Cumberland Sound and is 2 miles from the bar. The harbor is about 1,300 feet in width at the entrance and about 2 miles long. It embraces about 160 acres of well-sheltered anchorage ground, with a depth greater than 25 feet at mean low water, but is somewhat obstructed by small shoals. Above this basin there exists a shoal some 4,000 feet in length, with low-water depths over same ranging from 14 to 18 feet. Above this shoal the river separates into two estuaries, which carry deep water for about 2 miles.

A project providing for such extensions of the depth and width of the channel in front of the town of Fernandina as will meet the requirements of commerce will be found printed as House Document No. 388, Fifty-ninth Congress, first session.

The improvement proposed consists in dredging a channel with widths varying from 400 to 600 feet and depths from 20 to 24 feet at mean low water, in front of and to a short distance above (southwest of) the city of Fernandina. The estimated first cost of this work is $115,000, with $15,000 at periods of every two or three years for maintenance after completion.

This project was adopted by act of Congress approved March 2, 1907, which appropriated $115,000 for its completion.

Work under the project was begun September 14, 1907, and at the close of the fiscal year all dredging provided for was practically completed.

On June 30, 1908, the controlling depth in the channel just above Old Fernandina was 25 feet at mean low water, from a point opposite Calhoun street to the Hill and Nassau docks, 23 feet; and from this latter point to the mouth of Lanceford Creek, 21 feet. The mean rise and fall of tide is 6 feet.

The amount expended up to June 30, 1908, was $85,092.98.

On June 30 the project was about 90 per cent completed.

It is proposed to expend the available balance in completing the improvement.

Before the improvement of Cumberland Sound (in 1879), which constitutes the ocean entrance to Fernandina Harbor, the annual in and out bound tonnage at Fernandina was about 300,000, and the value of imports and exports estimated at about $2,500,000. The commerce of the port during the calendar year 1907 amounted to 730,000 tons, with a value of about $14,363,429. The chief articles of export are lumber, phosphate rock, and naval stores.

The effect of the improvement of Cumberland Sound has been to cause a reduction in freight rates of from 25 to 40 per cent. It can not now be said what further effect the improvement of Fernandina Harbor will have upon these rates.

July 1, 1907, balance unexpended	$115,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	85,092.98
July 1, 1908, balance unexpended	29,907.02
July 1, 1908, outstanding liabilities	14,776.76
July 1, 1908, balance available	15,130.26
July 1, 1908, amount covered by uncompleted contracts	7,419.99

(See Appendix O 11.)

12. Removing sunken vessels or craft obstructing or endangering navigation.—There was expended $1,197.79 during the fiscal year in connection with the removal, during the previous year, of the wreck of the American schooner *Arthur C. Wade*, sunk in Savannah Harbor.

(See Appendix O 12.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated April 18, 1907, and March 24, 1908, on preliminary examination and survey, respectively, of *Savannah River, for 30 miles below Augusta, Ga.*, required by the river and harbor act of March 2, 1907, were submitted by the district officer and were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law. They were transmitted to Congress and printed in House Document No. 962, Sixtieth Congress, first session. A plan for improvement, at an estimated cost of $360,000, is presented.

The local officer was also charged with the duty of making a resurvey of the inside water route between Savannah, Ga., and Fernan-

dina, Fla., required by the river and harbor act of March 2, 1907, and report thereon will be duly submitted when received.

IMPROVEMENT OF RIVERS AND HARBORS IN THE JACKSONVILLE, FLORIDA, DISTRICT.

This district was in the charge of Maj. Francis R. Shunk, Corps of Engineers, to August 26, 1907, and of Lieut. Col. Lansing H. Beach, Corps of Engineers, since that date. Division engineer, Lieut. Col. Dan C. Kingman, Corps of Engineers.

1. St. Johns River, Florida.—This work includes the improvement of the bar at the river mouth and the improvement of the channel from the bar to Jacksonville, a distance of 27.5 miles. Before improvement there was a varying channel across the bar, sometimes 5, sometimes 7 feet deep, and shifting in location through a north and south range of 1 mile. Between the bar and Jacksonville the channel had a least mean low-water depth (at Dames Point) of 11.5 feet.

The range of tide is 5.22 feet at the bar, 4.3 feet at Mayport, 1.8 feet at Dames Point, and 1 foot at Jacksonville.

The first project of improvement, adopted in 1879, contemplated a channel 15 feet deep at mean low water from Jacksonville to the ocean. This was to be obtained by dredging and building training walls in the river and by building two stone jetties converging upon the bar, 1,600 feet apart at their outer ends. Under this project the sum of $1,417,000 was expended. As a result the bar channel was fixed and deepened to 13 feet, and the river channel was deepened to 16.5 feet.

The present project, adopted in 1896 and modified in 1903, contemplates a channel from Jacksonville to the ocean 300 feet wide and 24 feet deep, except at Dames Point, where the width was to be 400 feet and the depth 25 feet, this channel to be obtained by dredging and building training walls in the river and by raising and extending the jetties. The estimated cost was $2,109,750, but for reasons stated in the district officer's report this estimate has been increased to $2,176,750.

The funds appropriated have been expended in building a seagoing suction dredge (*St. Johns*) and a river dredge (*Jacksonville*), in dredging with the plant thus provided and by contract, in building training walls, and in raising and extending the jetties at the entrance. The total expenditure to June 30, 1908, was $2,243,818.05, of which $175,175.99 was for construction of a seagoing dredge and $216,261.64 for work of maintenance. The result has been the completion of the channel contemplated by the project, excepting through the shoals at Trout Creek and at White Shells. At the first place the channel is only about 230 feet wide, the remaining 70 feet being obstructed by rock and soft material.

At White Shells the channel is narrowed about 60 feet by a ledge of coquina rock and has filled in until its width is not more than 150 feet. Shoaling occurred in the channel at Mile Point and White Shells, requiring work of maintenance. The mid-channel depth at the former place was restored during the year; at the latter the work was begun on the northerly side of the cut and carried as far to the southerly side as funds permitted. An available channel having a least depth of 24 feet now exists from the ocean to Jacksonville, although not yet such as *is contemplated* by the project.

The building up of the inner portion of the north jetty has undoubtedly materially assisted in the maintenance of the channel at the entrance, but the remaining low places in both jetties should be restored to the original height not only to secure future maintenance of the favorable conditions now obtaining, but also to prevent serious deterioration of the channel which will occur with certainty and rapidity unless the jetties are promptly restored to the height and condition which it was calculated from the first they must have to serve the purpose for which they were built. The district officer estimates that the sum of $225,000 will be required for this work and that the sum of $75,000 will be required in addition for the maintenance of the dredged channel in the river above the entrance, a total of $300,000.

Were it not for the improvement, freight rates from Florida to northern points would be 50 per cent greater than they are.

The St. Johns River is navigable from the mouth to Lake Washington, a distance of 276 miles, but for deep-draft vessels only as far as Jacksonville, 27.5 miles.

The estimated value of the commerce for 1907 is $60,627,831.

Tonnage by years: 1898, 494,474; 1899, 816,477; 1900, 649,221; 1901, 700,179; 1902, 903,191; 1903, 1,052,076; 1904, 1,000,316; 1905, 1,406,647; 1906, 2,455,101; 1907, 2,485,610.

More detailed information may be found in Reports of the Chief of Engineers as listed on page 329 in Report of the Chief of Engineers for 1907.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to widening the channel at White Shells cut and Trout Creek cut and for maintenance. The additional work proposed is for the purpose of extension of benefits.

July 1, 1907, balance unexpended		$112,997.13
Receipts from sales		342.41
November 26, 1907, allotted from emergency appropriation, river and harbor act of March 2, 1907		10,000.00
		123,339.54
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$12,135.04	
For maintenance of improvement	109,900.00	
		122,035.04
July 1, 1908, balance unexpended		1,304.50
July 1, 1908, outstanding liabilities		50.00
July 1, 1908, balance available		1,254.50
Amount (estimated) required for completion of existing project		67,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		367,000.00

(See Appendix P 1.)

2. St. Johns River, Florida, opposite the city of Jacksonville.—The project for improving the St. Johns River from Jacksonville to the ocean provides for a channel 24 feet deep. Between the navigable channel and the pierhead lines at the city of Jacksonville the depths

are in many places considerably less than 24 feet. A project for securing a depth of 24 feet at mean low water from the existing channel to the pierhead line on the left bank of the river, between the Florida East Coast Railway bridge and Hogans Creek, was adopted by the river and harbor act of March 2, 1907. The estimated cost (raised in 1908) is $586,500.

Work upon this project was commenced October 1, 1907, and was still in progress at the end of the fiscal year.

The total expenditure up to June 30, 1908, was $112,350.88. The result has been the removal of most of the shoal places between the railway bridge and the foot of Hogan street, forming about 26 per cent of the necessary work.

The average rise and fall of tide is 0.8 foot, although under special conditions the river sometimes rises to a height of 3 feet above mean low water.

For commercial statistics and other general information reference is made to the current report and summary on improvement of St. Johns River, Florida.

It is estimated that the completion of the project will reduce freight rates about 10 per cent.

It is proposed to apply the amount which is estimated as a profitable expenditure in fiscal year ending June 30, 1910, to the completion of the project which is necessary to make the improvement available.

July 1, 1907, balance unexpended	$371,500.00
June 30, 1908, amount expended during fiscal year for works of improvement	112,350.88
July 1, 1908, balance unexpended	259,149.12
July 1, 1908, outstanding liabilities	31,021.19
July 1, 1908, balance available	228,127.93
July 1, 1908, amount covered by uncompleted contracts	169,049.46
Amount (estimated) required for completion of existing project	215,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	215,000.00

(See Appendix P 2.)

3. St. Johns River at Orange Mills Flats, Florida.—The object of this work is to obtain a 13-foot channel at mean low water from Jacksonville to Palatka. Before improvement there were four shoals, all near Orange Mills, of less depth than 13 feet. These were Forresters Point shoal, least depth 11.6 feet; Orange Mills flats, 9.8 feet; Racey Point shoal, 10.1 feet; and Tocoi shoal, 11.1 feet.

The mean range of tide is 0.9 foot. The annual variation of water stage is about 3 feet.

The project, adopted in 1893, is to dredge a channel 200 feet wide and 13 feet deep through the shoals named. The estimated cost (increased in 1906) is $185,000.

The total expenditure up to June 30, 1908, was $118,506.50. The result has been the formation of a channel 13 feet deep, 160 feet wide, through Orange Mills flats and Forresters Point shoal and 120 feet wide through Racey Point and Tocoi shoals.

The project is about 64 per cent completed.

The river is navigable to Lake Washington, a distance of 276 miles.

The existence of the St. Johns waterway has probably had an important effect in keeping down freight rates, but the increase of the channel to 13 feet has not, so far as known, caused any changes in rates.

For more detailed information see Report of the Chief of Engineers for 1898, pages 1344–1348; for 1901, page 1738; for 1904, pages 1690–1691.

The commerce of the upper St. Johns is chiefly in lumber, shingles, building material, and general merchandise.

Tonnage by years: 1898, 25,866; 1899, 122,074; 1900, 171,500; 1901, 67,500; 1902, 167,950; 1903, 269,610; 1906, 559,838; 1907, 273,070.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to widening existing channels, completing the project. The additional work proposed is for the purpose of extension of benefits.

July 1, 1907, balance unexpended	$26,230.74
June 30, 1908, amount expended during fiscal year for works of improvement	24,737.24
July 1, 1908, balance unexpended	1,493.50
Amount (estimated) required for completion of existing project	65,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	65,000.00

(See Appendix P 3.)

4. Volusia bar, Florida.—The object of this improvement is to secure a channel 5 feet deep through the bar of that name at the head of Lake George, and from that lake to Lake Monroe. Before improvement the channel at this locality was very crooked, with a low-water depth varying between 3.5 and 4.5 feet.

The project, adopted in 1879 and modified in 1882 and 1887, provided for the construction of two converging jetties and for dredging, in order to secure a depth of 5 feet at mean low water, at an estimated cost of $25,000.

The project was completed in 1887 and additional work required is for maintenance. As shoaling is continual, it has been found necessary to dredge from time to time in order to maintain the requisite depth.

The total expenditure up to June 30, 1908, was $44,000, of which $19,000 was for work of maintenance. As a result there is now a channel from Palatka to Sanford having a least depth of 5 feet at mean low stage.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to maintenance of existing channels.

The usual variation of water level is 2 feet; the extreme variation, 3½ to 5 feet.

The existence of the St. Johns waterway has probably had an important effect in keeping down freight rates, but the increase of the channel depth to 5 feet has not, so far as known, caused any change in freight rates.

For more detailed information see Report of the Chief of Engineers for 1896, pages 1313–1314; for 1897, page 1550; for 1905, page 1296.

The commerce of this portion of the river is chiefly in grain, fertilizers, ship stores, vegetables, and general merchandise. The estimated value of the commerce for 1907 is $2,753,770.

Tonnage by years: 1898, 21,959; 1899, 26,358; 1900, 31,511; 1901, 32,437; 1902, 53,678; 1903, 55,922; 1904, 60,347; 1905, 111,162; 1906, 412,703; 1907, 66,005.

July 1, 1907, balance unexpended	$5,510.03
June 30, 1908, amount expended during fiscal year for maintenance of improvement	5,510.03
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix P 4.)

5. Oklawaha River, Florida.—Before improvement this river was obstructed by snags, accumulation of drift, and overhanging trees.

The project, adopted in 1891, was to clear the river of obstructions, so as to give a navigable channel 4 feet deep at mean low stage from the mouth to Leesburg, a distance of 94 miles, at an estimated cost of $26,000. This was modified by the river and harbor act of March 2, 1907, which provided for removing obstructions and deepening the channel to 6 feet at mean low water from the mouth of the Oklawaha to the head of Silver Springs Run at an estimated additional cost of $15,000. This project is printed in House Document No. 782, Fifty-ninth Congress, first session.

Up to June 30, 1908, the total expenditure under this project was $38,810.36, of which $16,208.07 was for work of maintenance.

As a general result, there is a fairly well cleared channel 6 feet deep for the first 32 miles of the stream, a practicable channel 4 feet deep at ordinary low stages of the river to Silver Springs Run, 53 miles from the St. Johns River, and a channel 3 feet deep at ordinary stage of water to Leesburg, the head of navigation, 94 miles from the mouth.

Owing to the unprecedentedly low water during the past several months this depth of 3 feet does not at present exist.

Silver Springs Run, 5½ miles long from the Oklawaha to its head at Silver Springs, affords the best channel of the entire route.

As a result of the expenditure for maintenance, several shoal places have been dredged and many snags and overhanging trees removed.

The original project is believed to be about 55 per cent completed, but owing to the fact that logs and snags are carried by freshets into the stream or moved from the sides into the channel, more work will have to be done than can be estimated from examination or survey.

During freshets the water sometimes rises to a height of 4 feet above its normal stage.

The improvement has had no appreciable effect upon freight rates.

The commerce concerned is small. The boats using the river are chiefly excursion steamers, which run during the winter months. One steamer, however, runs regularly during the entire year and affords the only means of communication for the adjacent country.

Tonnage by years: 1898, 4,481; 1899, 4,291; 1900, 4,847; 1901, 4,530; 1906, 9,298; 1907, 9,129.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year ending June 30, 1910, to making certain cut-offs, dredging shoals, and removing snags and overhanging trees in the lower river, and in deepening shoal places in the upper river. The additional work proposed is for the purpose of extension of benefits and for maintenance.

For further information see Report of Chief of Engineers for 1896, pages 1314–1316; for 1905, page 1298.

July 1, 1907, balance unexpended		$13,068.34
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$10,670.63	
For maintenance of improvement	2,208.07	
		12,878.70
July 1, 1908, balance unexpended		189.64
Amount (estimated) required for completion of existing project		18,208.07
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		6,000.00

(See Appendix P 5.)

6. Indian River, Florida, between Goat Creek and Jupiter Inlet.—Indian River is a narrow sound between the coast and an outlying fringe of islands. Before improvement the ruling depth was 2.5 feet. The tide is negligible.

The project adopted in 1891 provides for a continuous channel between Goat Creek and Jupiter Inlet 5 feet deep at mean low water and at least 75 feet wide in the straight reaches, with as much greater width as may be required in the turns. The estimated cost is $44,000.

The total expenditure up to June 30, 1908, was $52,372.36, of which $15,685.50 was for maintenance. As a result a channel was obtained 5 feet deep and nowhere less than 50 feet wide between Goat Creek and Pecks Lake. The work of maintenance has resulted in restoring the channel depth and width between Goat Creek and a point about 1 mile below St. Lucie Inlet. Between the latter point and Jupiter Inlet, a distance of about 15 miles, a few shoals have formed which slightly reduce the channel dimensions and these places still remain.

The project is about 80 per cent completed.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to deepening and widening existing channels, completing the project. The additional work proposed is for the purpose of extension of benefits.

The improvement has had no effect upon freight rates.

The commerce of Indian River is small. No statistics are available for 1907. The waterway is used only by launches, small local steamers, and sailing vessels.

For history, description, and project see Report of Chief of Engineers for 1896, pages 1318–1320; for 1905, page 1299; 1906, page 1220.

Tonnage by years: 1901, 66,593; 1902, 91,875.

July 1, 1907, balance unexpended	$9,327.76
Allotted from emergency appropriation, act of March 2, 1907	10,000.00
	19,327.76
June 30, 1908, amount expended during fiscal year for maintenance of improvement	15,685.50
July 1, 1908, balance unexpended	3,642.26
July 1, 1908, outstanding liabilities	2,848.77
July 1, 1908, balance available	793.49
Amount (estimated) required for completion of existing project	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance in addition to the balance unexpended July 1, 1908	9,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P 6.)

7. *Biscayne Bay, Florida.*—Before improvement, Biscayne Bay was navigable for boats drawing less than 3 feet of water. There was a channel, excavated at private expense, 12.5 miles long with a least depth of 10.5 feet, from Miami to the Atlantic Ocean near Cape Florida. The tidal range in the bay is about 1 foot.

The river and harbor act of June 13, 1902, adopted in part a plan proposed by a Board of Engineer officers appointed in accordance with a provision in the river and harbor act of March 3, 1899. This plan contemplated a channel 18 feet deep from the wharves at Miami to the sea by way of a line entering the sea at a point about 4,000 feet north of Norris Cut, and a refuge basin of same depth, 1,200 feet long and 400 feet wide, in some suitable place, this channel to be protected by one or two jetties, as might be found necessary. The estimated cost of the entire improvement was $1,493,743. (See H. Doc. No. 662, 56th Cong., 1st sess.) The act of 1902 appropriated and authorized an expenditure of $300,000 for part of this work, and provided that the Florida East Coast Railway Company should construct, at its own expense, a basin 1,600 feet long and 500 feet wide adjacent to the wharves at Miami and the channel from said basin to the east side of the proposed refuge basin on the east side of the bay; that the amounts appropriated and authorized by Congress should be expended in constructing and protecting the portion of the channel extending to the sea from the terminus of the channel to be constructed by the railway company, of such approximately uniform depth and of such widths as would best serve the interests of navigation and as could be constructed with the funds appropriated and authorized. The act further provided that before any part of the appropriation should be expended the said railway company should enter into a contract with the United States for the performance of its part of the work.

The act of March 2, 1907, modified the project by prescribing a width of 100 feet for the dredged channel, and by providing for a

jetty on the southern side of the entrance. The total estimated cost of the work authorized by Congress is $546,000, of which $27,000 remains to be appropriated under contract authorization of 1907.

The total expenditure up to June 30, 1908, was $263,179.03, of which $9,759.17 was for emergency work of maintenance by the construction of shore revetment. As a result there is an available channel 10 feet deep across the bay and the two jetties are nearly completed, the granite capping of the south jetty and of the outer portion of the north jetty being still lacking.

It is expected that the available balance will be expended in completing the jetties and in dredging and rock removal.

The project is about 46 per cent completed.

The improvement in its incomplete condition has had no effect in reducing freight rates.

A description of the bay, with report and recommendations of a Board of officers, may be found in Report of the Chief of Engineers for 1900, pages 1986 to 2013. (See also Report for 1905, pp. 1300–1302.)

Tonnage by years: 1899, 18,089; 1902, 8,390; 1903, 13,319; 1904, 16,788; 1905, 40,700; 1906, 56,405; 1907, 106,010.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to the completion of the project. The additional work proposed is necessary to make the improvement available.

July 1, 1907, balance unexpended	$202,115.67
Amount appropriated by sundry civil act approved May 27, 1908	119,000.00
	321,115.67
June 30, 1908, amount expended during fiscal year for works of improvement	55,535.05
July 1, 1908, balance unexpended	265,580.62
July 1, 1908, outstanding liabilities	37,528.09
July 1, 1908, balance available	228,052.53
July 1, 1908, amount covered by uncompleted contracts	129,808.91
Amount (estimated) required for completion of existing project	27,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	27,000.00

(See Appendix P 7.)

8. *Harbor at Key West, Fla., and entrance thereto.*—The entrance referred to is the northwest channel. While Key West Harbor accommodates vessels drawing about 27 feet, the ruling depth over the northwest bar, before improvement, was 10.5 feet at mean low water. The mean tidal range is 2.6 feet.

The project adopted in 1889 contemplated a channel 17 feet deep at mean low water. This was to be secured by building two stone jetties, one to the northeast and one to the west of the channel, converging toward the bar, and by dredging, if necessary. The estimated cost of the east jetty was $500,000. No estimate was made of the entire project.

The act of March 2, 1907, modified the project by authorizing continuance of work on the existing jetties or the building of training walls, in the discretion of the Secretary of War.

The total expenditure up to June 30, 1908, was $519,969.64. As a result the east jetty is about 50 per cent completed and the west jetty about 20 per cent; the seagoing suction dredge was built, and a channel has been dredged, having a least depth of 17 feet at mean low water over the northwest bar and a width of 100 feet. The maximum draft that could be carried on June 30, 1907, was 15.5 feet at mean low water.

It is proposed to apply the sum of $125,000 of the available balance to work on the east jetty and the remainder to dredging or to jetty work, as may appear most advisable in the light of later developments.

An act of Congress, approved May 28, 1908, authorized the expenditure of $5,000 for the purpose of removing certain reefs from the main ship channel from the appropriation for improving this harbor, and a project for the expenditure of the sum authorized has been approved. The obstructions consist of masses of coral growth locally known as "coral heads." No work had been done at the end of the year.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to maintenance.

The existence of the northwest channel has an important effect upon freight rates between Key West and Tampa.

The commerce is chiefly in cattle, fertilizers, tobacco, sponges, and general merchandise.

Tonnage by years: 1898, 72,968; 1899, 130,713; 1900, 30,594; 1901, 18,863; 1902, 14,146; 1903, 134,043; 1904, 174,305; 1905, 132,744; 1907, 189,258.

For further information see listed references on page 335, Report of Chief of Engineers for 1907. Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 369 of this report.

July 1, 1907, balance unexpended	$199,043.67
June 30, 1908, amount expended during fiscal year for works of improvement	6,459.84
July 1, 1908, balance unexpended	192,583.83
July 1, 1908, outstanding liabilities	204.40
July 1, 1908, balance available	192,379.43
Amount (estimated) required for completion of existing project	Unknown.
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	50,000.00

(See Appendix P 8.)

9. Kissimmee River, Florida.—Before improvement the Kissimmee River was tortuous, shallow, and obstructed by snags and overhanging trees. At ordinary stages the least depth was about 2 feet, and in dry seasons navigation was altogether suspended. Canals had been made through some of the worst bends by private enterprise.

The project, adopted June 13, 1902, provided for a channel 30 to 60 feet wide and 3 feet deep at ordinary low-water stages in the Kissimmee River (including the connecting canals and lakes) from the town of Kissimmee to Fort Bassinger, and for a channel 25 feet wide and 3 feet deep in Istokpoga Creek. The estimated cost of the improvement was $24,220.90.

The total expenditure to June 30, 1908, was $24,435.62, of which $3,659.54 was for work of maintenance. The project is 86 per cent completed.

The result has been a deepening of the channel to a depth of 3 feet from the town of Kissimmee to Fort Bassinger, at ordinary stages of the river, and the removal of 3 shoals from Istokpoga Creek, near its mouth.

On account of a long-continued drought the stream was not navigable on June 30, 1908. The maximum draft that can be carried at ordinary low-water stage is 15 inches. The annual variation of level of water surface is about 4 feet.

The town of Kissimmee is at the head of navigation. The entire route from Kissimmee to Fort Bassinger, 99½ miles, is navigable.

The commerce of Kissimmee River is in lumber, cattle, fish, naval stores, fruits, vegetables, and general merchandise. On account of the low stage of the river there was little or no navigation for the year 1907, and the value of commerce could not be obtained. Commercial statistics for the calendar year 1907 are not available.

Tonnage by years: 1901, 3,670; 1902, 9,655; 1903, 10,652; 1904, 2,863; 1905, 9,911; 1906, 10,111.

The project has lowered freight rates by enabling the steamboats to run more months in a year than they did formerly. Freight is hauled by wagons when steamboats are not running, as there are no railroads in the vicinity.

For reference to examination and survey, see page 289, Report of the Chief of Engineers for 1904.

It is proposed to apply the available balance to dredging and trimming overhanging trees in Istokpoga Creek. The appropriation recommended is for maintenance of the improvement. The work proposed is to make the improvement available.

July 1, 1907, balance unexpended		$10,956.61
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$5,769.69	
For maintenance of improvement	2,401.54	
		8,171.23
July 1, 1908, balance unexpended		2,785.38
July 1, 1908, outstanding liabilities		76.26
July 1, 1908, balance available		2,709.12
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix P 9.)

10. Orange River, Charlotte Harbor, and Caloosahatchee River, Florida.—These works were consolidated by the act of June 13, 1902.

(*a*) *Orange River.*—Before improvement the least depth was 2.5 feet at mean low water, and the channel was obstructed by snags and overhanging trees.

The project, adopted June 13, 1902, provides for a channel 50 feet wide and 4 feet deep at mean low water from the mouth of the river to the head of navigation. The estimated cost was $2,500.

The total expenditure to June 30, 1908, was $4,000, of which $2,000 was for work of maintenance.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to maintenance.

There is now a navigable channel 50 feet wide and 4 feet deep at mean low water from the mouth of the river to the head of navigation, excepting in the upper portion of the river the full channel width could not be obtained on account of the river width being less than 50 feet.

The mean rise and fall of the tide is 1 foot. The annual variation of water level on account of freshets is about 2 feet. The maximum draft that can be carried at mean low water is 4 feet.

The head of navigation is the iron bridge at Buckingham, about 5¾ miles from the mouth of the river.

The commerce of Orange River is in fruits, vegetables, fertilizers, lumber, and general merchandise. The value of the commerce for the year 1907 was $277,669.34.

Tonnage by years: 1896, 1,250; 1902, 7,155; 1903, 8,555; 1904, 3,099; 1905, 2,074; 1906, 6,258; 1907, 4,002.

The freight rates are practically the same as before the improvement was made.

For references to examinations and survey, see page 291, Report of Chief of Engineers for 1904, and page 369 of this report.

July 1, 1907, balance unexpended	$1,000.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *Charlotte Harbor and Caloosahatchee River from Puntarasa to Punta Gorda.*—This project was completed in 1903, and no further work is proposed. The amount expended is $106,000.

(*c*) *Caloosahatchee River between Puntarasa and Fort Thompson.*—Before improvement there was a navigable channel with a least depth of 5 feet at mean low water from Puntarasa to Fort Myers, and thence with a least depth of 3.5 feet to Fort Thompson. The upper river was obstructed by snags and overhanging trees.

The project, adopted in 1882 and modified in 1886 and 1888, provided for a channel 100 feet wide and 7 feet deep at mean low water from the mouth to Fort Myers, for a channel 4 feet deep at mean low water across the shoal at Beautiful Island, and for snagging and cutting trees on the upper river.

The project was completed in 1901, at a total cost of $33,600; the results contemplated were obtained.

Since that time $7,468.76 has been expended in work of maintenance. As a result there is a channel 4 feet deep from Fort Myers to Fort Thompson at ordinary stages of water.

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[a] *See consolidated* money statement on page 358.

On May 12, 1908, the Secretary of War allotted the sum of $3,000 from the emergency appropriation ($300,000) of the river and harbor act of March 2, 1907, for maintenance operations, consisting of dredging shoals, removing snags, and trimming overhanging trees.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to maintenance.

The maximum draft that could be carried on June 30, 1908, was 7 feet from the river entrance to Fort Myers and thence 4 feet to Fort Thompson. The mean rise and fall of tide at the river entrance is 1.6 feet. During freshets the water level in the upper reaches of the river rises considerably. The head of navigation is Fort Thompson. The navigable portion of the river from the mouth to Fort Thompson is 59.5 miles long.

The commerce of Caloosahatchee River is in fruits, vegetables, fertilizers, and general merchandise. The value of the commerce for the year 1907 was $250,298.17.

Tonnage by years: 1899, 33,101; 1900, 22,737; 1902, 27,895; 1903, 27,576; 1904, 12,255; 1905, 9,577; 1906, 22,265; 1907, 4,467.

No change in the nature of the commerce has resulted from the improvement. The freight rates are practically the same as before the improvement was made.

References to reports on examinations ordered by the river and harbor acts of March 3, 1905, and March 2, 1907, will be found on page 332 of the Annual Report of the Chief of Engineers for 1906, and on page 369 of this report.

July 1, 1907, balance unexpended	$1,663.90
Allotted from emergency appropriation, act of March 2, 1907	3,000.00
	4,663.90
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,632.66
July 1, 1908, balance unexpended	3,031.24
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

CONSOLIDATED.

July 1, 1907, balance unexpended	$2,663.90
Allotted from emergency appropriation, act of March 2, 1907	3,000.00
	5,663.90
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,632.66
July 1, 1908, balance unexpended	3,031.24
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix P 10.)

11. Sarasota Bay, Florida.—Before improvement there was a navigable channel in Sarasota Bay with least depth of 5 feet at mean low water, except at two shoals, where the depths were 4.3 and 3.5

[a] See consolidated money statement on this page.

feet, respectively. Little Sarasota Bay had a channel with a least depth of 1.2 feet at mean low water, except at one shoal which was bare at low water.

The project, adopted in 1889, provides for a channel 100 feet wide and 5 feet deep at mean low water from Tampa Bay to Sarasota at an estimated cost of $17,500.

The sum of $10,000 had been expended under this project when it was modified (in 1896) to include a channel 75 feet wide and 3 feet deep in Little Sarasota Bay from Sarasota to Caseys Pass. The estimated cost of completion of the entire project was $45,000, making a total estimate of $55,000, subsequently increased to $70,000.

The river and harbor act of March 2, 1907, provided for continuing improvement from Tampa Bay to Venice. Venice is about 2 miles southeasterly from Caseys Pass. An examination of the waters between Caseys Pass and the wharf near Venice, made in the spring of 1908 while dredging operations were in progress near there, showed that the least depth is 3 feet. Therefore, in accordance with the existing project, no work is necessary beyond Caseys Pass.

The total expenditure to June 30, 1908, was $55,035.25, of which $10,077.18 was for work of maintenance.

The project, as modified by the river and harbor act of March 2, 1907, is about 61 per cent completed.

As a result there is a channel 50 feet wide and 5 feet deep at mean low water from Tampa Bay to Sarasota. From Sarasota to Caseys Pass the channel is 3 feet deep at mean low water, and varying in width from 50 to 75 feet.

The maximum draft that could be carried on June 30, 1908, was 5 feet to Sarasota, and thence to Caseys Pass, 3 feet. Mean rise and fall of tide is 1.5 feet.

The work proposed will be partly for extension of benefits and partly to keep the improvement available.

The commerce of Sarasota Bay is in naval stores, fruits, vegetables, fertilizers, fish, lumber, and general merchandise. The value of commerce for the calendar year 1907 was $606,671.10.

Tonnage by years: 1899, 9,424; 1902, 4,313; 1903, 4,755; 1904, 25,479; 1905, 8,556; 1906, 12,010; 1907, 13,350.

The freight rates have been lowered 25 to 50 per cent, depending on freight classification, since the improvement was undertaken.

For reference to examination and survey, see page 293, Report of Chief of Engineers for 1904.

July 1, 1907, balance unexpended	[a]$18,738.33
June 30, 1908, amount expended during fiscal year for works of improvement	18,730.83
July 1, 1908, balance unexpended	7.50
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	20,000.00

(See Appendix P 11.)

[a] Balance unexpended as shown by the Annual Report for 1907 should read $18,738.33.

12. Manatee River, Florida.—Before improvement there was a least depth of 9 feet at mean low water over the bar at the river mouth; thence to Palmetto the least depth was about 6 feet; thence to Bradentown about 3 feet; thence to Ellenton 7 feet; thence to Rocky Bluff 6 feet; thence to Rye 1½ feet.

The first project, adopted in 1882, contemplated a channel 100 feet wide and 13 feet deep at mean low water from Tampa Bay to Shaw and McNeills points, a distance of 4 miles. This was changed in 1886 so as to provide for a channel 100 feet wide and 8 feet deep from Tampa Bay to Manatee, a distance of 9 miles.

The total expenditure under this project was $34,000.

In 1892 a new project was adopted reverting to the original plan of a channel 13 feet deep and 100 feet wide to Shaw and McNeills points. The estimated cost was $39,000. The sum of $12,000 was expended under this project.

As a result of work under all these projects a channel was obtained 100 feet wide and 9 feet deep to Bradentown, thence 8 feet deep to Manatee.

In 1897 a project was adopted for a cut-off to Terraceia Bay, at an estimated cost of $20,000. This was completed to a width of 100 feet and a depth of 6 feet at mean low water, for a total expenditure of $13,342.

The present project, adopted March 3, 1905, provides for a channel 100 feet wide and 9 feet deep from McNeills Point to Rocky Bluff, and a channel 75 feet wide and 4 feet deep from Rocky Bluff to Rye. The estimated cost is $53,710.

The total expenditure on the present project to June 30, 1908, was $18,454.35. There is now a channel 100 feet wide and 7 feet deep at mean low water as far as Rocky Bluff, thence 75 feet wide and 4 feet deep to Rye.

A maximum draft of 9 feet could be carried to Bradentown, 8 feet to Ellenton, 7 feet to Rocky Bluff, and 4 feet to Rye on June 30, 1908, and 6 feet through Terraceia Cut-off.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to maintenance.

Mean rise and fall of tides at Manatee River entrance is 1.6 feet. The annual variation of water surface in the upper river on account of freshets is about 3 feet.

The head of navigation is Rye and length of the navigable channel is 20 miles.

The commerce of the river is in fruits, vegetables, fuller's earth, lumber, naval stores, and general merchandise.

No commercial statistics for the year 1907 are available.

Tonnage by years: 1898, 23,800; 1899, 43,542; 1900, 55,162; 1902, 34,495; 1903, 44,367; 1904, 46,517; 1905, 49,644; 1906, 88,153.

Freight rates have not materially changed as a result of the improvement.

For report of examination and survey made in 1902, see pages 1749–1756, Report of Chief of Engineers for 1904.

It is proposed to apply the available balance to dredging in order to complete the project, and to maintenance.

The present project was 38 per cent completed on June 30, 1908.

July 1, 1907, balance unexpended	$68,889.76
June 30, 1908, amount expended during fiscal year for works of improvement	6,625.31
July 1, 1908, balance unexpended	62,264.45
July 1, 1908, outstanding liabilities	766.00
July 1, 1908, balance available	61,498.45
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P 12.)

13. Tampa Bay, Florida.—Before improvement the least depth between the Gulf of Mexico and Port Tampa was 13 feet.

The first project, adopted August 11, 1888, contemplated a channel 200 feet wide and 20 feet deep at mean low water from Tampa Bay to Old Tampa Bay. The estimated cost was $63,000. Prior to this work was carried on in connection with improvement of Hillsboro Bay.

The toal expenditure under this project was $50,000.

A new project was adopted March 3, 1899. It provided for a channel 27 feet deep at mean low water from the Gulf of Mexico to Port Tampa, 500 feet wide across the bar and 300 feet wide in the bay, a channel of full width and 24 feet deep to be first secured, and subsequently deepened. The estimated cost was $750,000.

The total expenditure under this project was $345,045.80. As a result a channel was formed 128 to 300 feet wide, with a least depth of 24 feet at mean low water.

The project was modified March 3, 1905, by reducing the proposed depth to 26 feet and by providing that no expenditure should be made until the owners of the terminals at Tampa Bay should by valid contract agree that the wharfage charges at such terminals should be submitted for approval to the Secretary of War. A schedule of such charges was approved by the Secretary of War on October 26, 1906.

The amount expended under the revised project to June 30, 1908, was $171,319.45, including contingent expenses and completion of the Government dredge *Key West.*

Operations during the year consisted in dredging with Government plant and, under contract, in prosecution of the project, which is 54 per cent completed.

The maximum draft that can be carried at mean low water is 24 feet. Mean rise and fall of tide at Tampa Bay entrance is 1.5 feet and at Port Tampa 2 feet.

The head of navigation for 24-foot draft is Port Tampa, 35 miles from deep water in the Gulf of Mexico.

The commerce is in phosphate, lumber, coal, crude petroleum, tobacco, grain, and general merchandise. The value of commerce for the year 1907 was $12,343,675.15.

Tonnage by years: 1896, 276,638; 1898, 236,136; 1899, 238,305; 1900, 350,761; 1901, 416,503; 1902, 462,703; 1903, 435,867; 1904, 591,181; 1905, 604,131; 1906, 838,378; 1907, 885,202.

The freight rates have been lowered 20 per cent on phosphate shipments since the improvement was undertaken.

It is proposed to expend the available balance in dredging. The proposed work is for extension of benefits.

For report of examination and survey of Tampa Bay, see Report of Chief of Engineers for 1897, page 1596 et seq.

July 1, 1907, balance unexpended	$229,200.18
Receipts from sales	10.75
	229,210.93
June 30, 1908, amount expended during fiscal year for works of improvement	135,551.72
July 1, 1908, balance unexpended	93,659.21
July 1, 1908, outstanding liabilities	16,782.79
July 1, 1908, balance available	76,876.42
July 1, 1908, amount covered by uncompleted contracts	72,481.50
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	25,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P 13.)

14. Hillsboro Bay, Florida.—Before improvement the channel from deep water in Hillsboro Bay to the city of Tampa was narrow and tortuous, with least depth of about 4 feet at mean low water.

The first project, adopted in 1880, provided for a channel 9 feet deep at mean low water, 150 feet wide in the bay and 200 feet wide in Hillsboro River. In 1888 the proposed depth was reduced to 8 feet. This project was practically completed in 1893, at a cost of $80,000.

A second project, adopted March 3, 1899, contemplated a channel 12 feet deep at mean low water, 150 feet wide in the bay and 200 feet wide in the river, from the 12-foot contour in the bay to a point 100 feet south of the Lafayette Street Bridge in Hillsboro River. The estimated cost was $300,000. The total expenditure under this project was $275,000. The project was completed, except that the width in a small part of the bay channel was only 110 feet.

A new project adopted March 3, 1905, provided for a channel 20 feet deep at mean low water and 150 feet wide from the lower bay to the mouth of Hillsboro River, with a turning basin at inner end 450 feet wide and 1,050 feet long, at an estimated cost of $448,350. The work was completed on February 29, 1908. The full depth was obtained in the channel excepting in the northwesterly end of the turning basin, where there is a minimum depth of 16.8 feet at mean low water, that having been permitted by a supplemental agreement entered into with the contractor on September 24, 1907.

The total expenditure to June 30, 1908, under this project was $410,014.53.

The maximum draft that can be carried at mean low water through Hillsboro Bay to the head of the turning basin, 360 feet from the mouth of Hillsboro River, is 20 feet. Mean rise and fall of the tide in Hillsboro Bay is 2.2 feet.

The head of navigation for 20-foot draft vessels is Hendry & Knights Garrison dock at Tampa, which is situated on a channel

connecting with the turning basin that was dredged by private capital. The head of navigation is 41 miles from deep water in the Gulf of Mexico.

The commerce of Hillsboro Bay is in fruits, vegetables, fertilizers, fuller's earth, naval stores, lumber, and general merchandise. The value of the commerce for the year 1907 was $18,325,791.53.

Tonnage by years: 1898, 32,070; 1899, 87,740; 1900, 96,029; 1901, 131,208; 1902, 169,844; 1903, 228,252; 1904, 274,399; 1905, 307,460; 1906, 450,056; 1907, 520,629.

The freight rates by water have been lowered about 25 per cent since the improvement was undertaken.

For reference to examination and survey see page 295 of Report of Chief of Engineers for 1904.

It is proposed to expend the available balance for maintenance of the project.

July 1, 1907, balance unexpended	$148,377.59
Receipts from sales, $20.24; monuments at Gasparilla Island, $175.15	195.39
	148,572.98
June 30, 1908, amount expended during fiscal year for works of improvement	111,024.48
July 1, 1908, balance unexpended	37,548.50
July 1, 1908, outstanding liabilities	500.00
July 1, 1908, balance available	37,048.50
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix P 14.)

15. Crystal, Anclote, and Suwanee rivers, Florida.—These works were consolidated by the act of June 13, 1902, and included Manatee and Withlacoochee rivers. The river and harbor act of March 3, 1905, made separate provision for Manatee River, and the act of March 2, 1907, made separate provision for Withlacoochee River.

(*a*) *Crystal River.*—Before improvement the channel from the Gulf of Mexico to the town of Crystal River was tortuous and shallow, the least depth being 2.7 feet at mean low water. The entrance to the river was obstructed by reefs and sand bars.

The project, adopted June 13, 1902, contemplates a channel 60 feet wide and 6 feet deep at mean low water from the Gulf to the town of Crystal River. The estimated cost is $84,647.46.

The total expenditure to June 30, 1908, was $23,476.67, of which $2,700 was for completion of the dredge *Florida*.

The project was completed on December 6, 1906.

The maximum draft that can be carried at mean low water is 2.7 feet. Mean rise and fall of the tide is 2.3 feet.

The town of Crystal River is at the head of navigation, and the length of the navigable channel is 9 miles.

The commerce of Crystal River is in lumber, pencil cedar, oysters, fish, and general merchandise. The value of the commerce for the year 1907 was $260,842.25.

Tonnage by years: 1902, 1,785; 1903, 725; 1904, 6,875; 1905, 7,474; 1906, 8,291; 1907, 7,888.

The freight rates have been lowered 10 per cent since the improvement was undertaken.

For references to examinations and surveys see page 296 of Report of Chief of Engineers for 1904, and page 369 of this report.

It is proposed to expend the available balance in maintenance.

July 1, 1907, balance unexpended	$2,506.72
June 30, 1908, amount expended during fiscal year for works of improvement	776.67
July 1, 1908, balance unexpended	1,730.05

(*b*) *Anclote River, Florida.*—Before improvement the channel below Tarpon Springs was narrow and tortuous and obstructed by shoals. The least mean low-water depth was 2 feet.

The project, adopted March 3, 1899, contemplates a channel 100 feet wide and 6 feet deep at mean low water from Anclote anchorage to Sponge Harbor, and thence 4 feet deep at mean low water to the county bridge at Tarpon Springs. The estimated cost was $51,500.

The total expenditure to June 30, 1908, was $20,654.06. There is now a channel 6 feet deep and 50 feet to 100 feet wide from Anclote anchorage to Sponge Harbor, and a channel 50 feet wide and 4 feet deep from Sponge Harbor to the bridge at Tarpon Springs.

The maximum draft that can be carried at mean low water is 6 feet from Anclote anchorage to Sponge Harbor, and thence 4 feet to the county bridge at Tarpon Springs.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to widening existing channels, completing project. The additional work proposed is for the purpose of extension of benefits.

The mean rise and fall of tide at Anclote River entrance is 2 feet. The head of navigation is the county bridge at Tarpon Springs. The length of the navigable channel is 5 miles.

The commerce of Anclote River is in sponges, lumber, naval stores, and general merchandise.

Tonnage, by years: 1899, 1,441; 1900, 1,000; 1903, 2,138; 1904, 8,310; 1905, 31,050. No statistics are available for 1907.

The freight rates have been lowered about 20 per cent.

The project was 39 per cent completed at end of the fiscal year.

For reference to examination and survey see page 297 of Report of Chief of Engineers for 1904.

It is proposed to expend the available funds in dredging in continuation of the improvement.

July 1, 1907, balance unexpended	$17,000.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	654.06
July 1, 1908, balance unexpended	16,345.94
Amount (estimated) required for completion of existing project	14,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

a See consolidated money statement on page 366.

(c) *Suwanee River, Florida.*—Before improvement the channel in the Suwanee River was narrow and tortuous and obstructed by a bar at the entrance and by bowlders, soft rock shoals, snags, and overhanging trees. The least depth at mean low-water stage was 15 inches.

The project, adopted in 1879, provides for a channel 150 feet wide and 5 feet deep from the mouth to Rollands Bluff (75 miles) and thence 60 feet wide and 4 feet deep to Ellaville (60 miles). This is to be secured by dredging, building wing dams, and snagging. The estimated cost is $65,158.

The total expenditure up to June 30, 1908, was $68,662.10, of which $9,203.96 was for maintenance.

The project was 92 per cent completed on June 30, 1908.

As a result, there is now a channel 5.8 feet deep at mean low water and 50 feet wide from the Gulf of Mexico to a distance of one-half mile above the mouth of the river, and thence to Rollands Bluff a channel 5 feet deep at mean low water and 100 feet wide. From Rollands Bluff to Beesons shoal, 2½ miles below Ellaville, there is a channel 4 feet deep at mean low water and varying from 30 to 100 feet in width.

The maximum draft that can be carried at the river entrance is about 4 feet.

Mean rise and fall of tide at Suwanee River entrance is 2.4 feet. The annual variation of the water surface in upper river on account of freshets is about 5 feet.

The village of Ellaville is at the head of navigation. Length of the navigable channel is 135 miles.

The commerce of Suwanee River is in lumber, naval stores, and general merchandise. The value of the commerce for the year 1907 was $560,603.23.

Tonnage, by years: 1898, 106,346; 1899, 76,878; 1904, 7,658; 1907, 25,705.

The improvement has had no effect on freight rates. Only three steamers now operate on the river occasionally.

It is proposed to expend the available funds in dredging.

The proposed work is for extension of benefits.

July 1, 1907, balance unexpended	$7,900.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	825.20
July 1, 1908, balance unexpended	7,074.80
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

[a] See consolidated money statement on page 366.

CONSOLIDATED.

July 1, 1907, balance unexpended		$27,406.72
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$776.67	
For maintenance of improvement	1,479.26	
		2,255.93
July 1, 1908, balance unexpended		25,150.79
Amount (estimated) required for completion of existing project		14,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		19,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P 15.)

16. Withlacoochee River, Florida.—Before improvement the entrance to the Withlacoochee River was crooked and obstructed by reefs. The least depth at mean low water was about 3 feet. Vessels loaded and discharged at an anchorage (called the loading pool) about 9 miles from the entrance. Inside the mouth there was a depth of 7 to 8 feet as far as Inglis, a distance of 9 miles.

The original project, adopted in 1879, provided for a channel having an available depth of 2 feet during about half the year from the mouth of the river to Pembertons Ferry, a distance of 77 miles, and was completed in 1892, at a cost of $24,403.62. A balance of $296.38, together with $5,000 from the consolidated appropriation made by the river and harbor act of 1902, was applied to the construction of the dredge *Florida.*

A project adopted June 13, 1902, provided for straightening the channel from the loading pool to the river mouth and deepening it to 8 feet, and for work of maintenance.

The amount expended to June 30, 1907, was $30,000.41. As a result there is now a channel with a least depth of 7.8 feet at mean low water and a least width of 60 feet through the most obstructive shoals.

A good deal of dredging has been done by the Port Inglis Terminal Company, under permission granted by the Secretary of War.

The present project, adopted by the river and harbor act of March 2, 1907, provides for a channel 100 feet wide and 10 feet deep at mean low water from Port Inglis to the anchorage in the Gulf of Mexico, at an estimated cost of $215,400, and $5,000 annually for maintenance. The act authorized continuing contracts for completing the work in the sum of $150,000, of which amount $50,000 is yet to be appropriated. Work under this project was commenced on April 11, 1908, and at end of the fiscal year the project was 3 per cent completed. The amount expended on present project to June 30, 1908, was $1,189.69.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to completing project. The additional work proposed is necessary to make the improvement available.

The mean rise and fall of tide at Withlacoochee River entrance is 2.8 feet. The annual variation of water surface in the upper river on account of freshets is about 6 feet.

The head of navigation is Pembertons Ferry.

Length of the navigable channel from the loading pool in the Gulf of Mexico to Port Inglis, at mouth of the river, is 9 miles; thence up the river to Inglis, 9 miles; thence to Pembertons Ferry, 68 miles.

The commerce of Withlacoochee River is in phosphate, lumber, coal, iron pyrites, and general merchandise. Port Inglis, at mouth of the river, is a subport of entry. Vessels ply regularly from the anchorage basin off the river entrance to European ports with cargoes of phosphate.

The value of the commerce for 1907 was $2,070,302.75.

Tonnage, by years: 1899, 4,941; 1900, 2,550; 1902, 74,047; 1903, 115,269; 1904, 123,369; 1905, 249,884; 1906, 181,226; 1907, 206,509.

The freight rates have been reduced about 30 per cent since the improvement was begun.

It is proposed to expend the available funds for dredging.

For improvement of the river, see Report of Chief of Engineers for 1904, pages 298-299 and 1710-1711.

For report on preliminary examination and survey authorized by the river and harbor act of March 3, 1905, see House Document No. 483, Fifty-ninth Congress, second session.

July 1, 1907, balance unexpended	$65,400.00
Amount appropriated by sundry civil act approved May 27, 1908	100,000.00
	165,400.00
June 30, 1908, amount expended during fiscal year for works of improvement	1,189.69
July 1, 1908, balance unexpended	164,210.31
July 1, 1908, outstanding liabilities	7,662.79
July 1, 1908, balance available	156,547.52
July 1, 1908, amount covered by uncompleted contracts	188,441.89
Amount (estimated) required for completion of existing project	50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix P 16.)

17. Removing the water hyacinth from Florida waters.—Before improvement many Florida rivers, especially the St. Johns and its tributaries, were badly obstructed by packs of hyacinths. The first project, adopted March 3, 1899, provided for the construction of a boat and booms and for destroying the water hyacinths by crushing. The estimated cost was $36,000, plus an undetermined amount for annual expenditure. Nothing was done under this project, as experience in Louisiana showed that destruction by crushing was impracticable.

In 1902 a new project was adopted, providing for the destruction of the hyacinths by any means whatsoever. The plan adopted under this project was to spray the plants with an arsenical compound. The estimated cost was $50,000 per annum.

Under this project the sum of $84,977.97 was expended. A steamer was purchased and fitted up for spraying, and the main stream of

the St. Johns River and a number of tributaries were cleared of hyacinths.

The act of 1905 modified the project by prohibiting any process injurious to cattle. The plan consequently adopted is to close inlets, sloughs, etc., with booms, to break up the packs with a suitable boat, and propel them into the current in order that they may float away.

The work during the year was mainly on Peters Creek, Trout Creek, Sixmile Creek, and Oklawaha River, all tributaries of the St. Johns River.

The total expenditure up to June 30, 1908, was $108,258.60. In addition to the information obtained as a result of exhaustive experiments, the St. Johns River and many of its tributaries, 11 miles of the Withlacoochee River, and 15 miles of the Kissimmee River were cleared of hyacinths, in so far as they formed an obstruction to navigation.

It is expected that the available balance will be expended in removing the hyacinth from the navigable streams of Florida.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to continuing work of removing water hyacinths. The additional work proposed is for the purpose of extension of benefits.

For further information see Reports of Chief of Engineers listed on page 346 of the Report of the Chief of Engineers for 1907, and see also pages 1333–1334 of the report for 1907.

July 1, 1907, balance unexpended	$24,671.76
Receipts from sales, $97.50, rent of steamer *Capt. Maguire*, $311.30	408.80
	25,080.56
June 30, 1908, amount expended during fiscal year for works of improvement	6,922.36
July 1, 1908, balance unexpended	18,158.20
Amount (estimated) required for completion of existing project	Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix P 17.)

18. Removing sunken vessels or craft obstructing or endangering navigation.—The wreck of the steamer *Ruby* from the St. Johns River, Florida, near the westerly limits of the city of Jacksonville, was removed by the Government snag and dredge boat *Florida* December 27 to 30, 1907.

A second wreck below the railroad bridge was reported a day or two after the *Ruby* was removed, and examination showed it to be a dangerous obstruction. This was likewise removed by the *Florida* January 3 to 6, 1908. The total cost of this work, including incidentals, was $400. The boiler removed from the wreck of the steamer *Ruby* was sold at auction for $50.50.

The wreck of the schooner *Eugene Batty* in the northerly end of Hillsboro Bay, Florida, was removed April 13 to 16, 1908, by the use of a hired plant, at a total cost, including incidentals, of $227.57.

Funds have been allotted for removing several obstructions in the channel of Hillsboro River at Tampa, Fla. The obstructions consist of several piles and the wreck of an old phosphate dredge and washer. These obstructions had not been removed at the end of the year.

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination of Caloosahatchee River, Florida, from Lake Okechobee to the Gulf, including Orange River.*—Report dated July 20, 1907, is printed in House Document No. 347, Sixtieth Congress, first session. The localities are not considered worthy of improvement by the United States further than contemplated by existing projects.

2. *Preliminary examination of Crystal River, Florida.*—Report dated August 9, 1907, is printed in House Document No. 395, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States further than contemplated by the existing project.

3. *Preliminary examination of Wekiwa (Wekiva) River, Florida.*—Report dated June 6, 1907, is printed in House Document No. 532, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

4. *Preliminary examination of harbor at Key West, Fla.*—Report dated March 5, 1908, is printed in House Document No. 970, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States except as contemplated by the existing project.

The local officer was also charged with the duty of making preliminary examinations and surveys provided for in the river and harbor act of March 2, 1907, as follows, and reports thereon will be duly submitted when received:

1. *St. Lucia Inlet, Florida.*
2. *Estero Bay, Florida.*
3. *Hillsboro Bay, Florida, from turning basin to head of the estuary in the direction of Ybor.*
4. *Clearwater Harbor and Boca Ceiga Bay to Tampa Bay, Florida.*
5. *St. Johns River, Florida, from Sanford to Lake Harney.*
6. *St. Johns River, Florida, from Jacksonville to Sanford.*

IMPROVEMENT OF RIVERS AND HARBORS IN THE MONTGOMERY, ALABAMA, DISTRICT.

This district was in the charge of Maj. J. B. Cavanaugh, Corps of Engineers, to October 9, 1907, and of Capt. H. B. Ferguson, Corps of Engineers, since that date. Division engineer, Col. E. H. Ruffner, Corps of Engineers.

1. East Pass and Carrabelle bar and harbor, Florida.—The town of Carrabelle is situated at the mouth of Carrabelle River, which empties into St. George Sound. The river forms the inner harbor and along the water front its channel varies from 9 to 14 feet in depth, with a minimum width of about 100 feet.

Dog Island anchorage, a protected portion of St. George Sound, showing a 4-fathom depth over a considerable area, forms the outer harbor. Between the 10-foot contours in the inner and outer harbors there is a bar about 6,000 feet wide, which originally had a minimum low-water depth over it of 3½ feet to 4 feet.

Dog Island anchorage is connected with the Gulf of Mexico by East Pass, which originally had limiting low-water depths of about 17 feet on the outer bar and 16.5 feet on the inner bar.

The approved project for Carrabelle bar and harbor, Florida, adopted June 3, 1896, provides for dredging a channel 10 feet deep and 100 feet wide from Dog Island anchorage, St. George Sound, to the city of Carrabelle, at a cost estimated in 1900 at $47,300, in addition to appropriations already expended on the project amounting to $22,399.54. By act of Congress approved June 13, 1902, this project was extended to include the improvement of East Pass by dredging a channel across the bar 20½ feet deep and 150 feet wide, and closing an opening in Dog Island, at an estimated cost of $27,450.

This project is about 30 per cent completed.

By act of Congress approved March 2, 1907, the project was further extended to include a channel 18 feet deep and 100 feet wide from the 18-foot contour in the outer harbor to a point opposite the beacon situated about 1,000 feet up the river from its mouth, with a suitable turning basin, but the size of the basin was not fixed by Congress, and the estimated cost of the extension of the project has not been determined.

The amount expended up to the close of the fiscal year ending June 30, 1908, was $80,511.46, of which $21,704.08 was expended prior to estimate of 1900, and about $31,298.51 has been applied to maintenance.

The channel at the mouth of the river has been partially dredged from time to time. During 1906 it was completed to a width of 100 feet and a depth of 10 feet from the wharves at Carrabelle to a point 1,400 feet south of the red beacon, and also widened 100 feet at the turn opposite Timber Island, but it shoaled at the inner end. During the past fiscal year a channel 100 feet wide and 10 feet deep has been dredged from the wharves at Carrabelle for a distance of 5,130 feet. The remaining part of the channel has a depth of 10 feet for a width of about 80 feet, and the maximum draft that could be carried through the channel to the inner harbor on June 30, 1908, was 10 feet.

The shoaling of this channel is believed to be due largely to storm action, and it should be protected to the eastward. This will be largely accomplished by the work which the Georgia, Florida and Alabama Railway Company is to undertake.

In 1904 the channel across the outer bar was deepened by dredging from about 17 feet to 20 feet, and across the inner bar from about 16.5 feet to 17.5 feet, this limiting depth being confined to a short distance.

As the crooked channel through the crossover and around the inner bar is about 1½ feet deeper than the dredged channel, the limiting depth through East Pass on June 30, 1908, was 19 feet at mean low water.

The ordinary range of the tide is about 2 feet.

The commerce of the port of Carrabelle, Fla., consists principally of timber, naval stores, dressed and kiln-dried lumber, shingles, fish, oysters, and general merchandise, and for the year ending June 30, 1908, it is estimated at a valuation of $400,000.

With the completion of the project, a substantial reduction in ocean rates may be expected, due to increased draft and improved facilities for lighterage, and a further reduction on freight handled by rail should result from the improvements projected by the Georgia, Florida and Alabama Railway Company in connection with the 18-foot channel and turning basin.

It is proposed to apply the amount estimated as a profitable expenditure during the fiscal year ending June 30, 1910, in maintenance to keep the improvement available.

Reference to reports on examinations and surveys of this harbor will be found on pages 333 and 355 of Report of the Chief of Engineers for 1906.

July 1, 1907, balance unexpended	$62,491.13
June 30, 1908, amount expended during fiscal year for maintenance of improvement	13,798.51
July 1, 1908, balance unexpended	48,692.62
July 1, 1908, outstanding liabilities	45,591.89
July 1, 1908, balance available	3,100.73
July 1, 1908, amount covered by uncompleted contracts	44,516.80
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	75,000.00

(See Appendix Q 1.)

2. Harbor at Apalachicola Bay, Florida.—The town of Apalachicola lies at the mouth of the Apalachicola River, and the deep water along the river front forms the inner harbor.

At the mouth of the river, between the inner harbor and the 3-fathom anchorage area in Apalachicola Bay, there is a bar of which the original width between 8-foot contours was 7,000 feet and the minimum depth of water 3.5 feet. Across this bar the lumber exported is lightered either to the 3-fathom anchorage in Apalachicola Bay or through Bulkhead shoals to the anchorage of Carrabelle, 25 miles distant. The 3-fathom anchorage area is entered via West Pass, where originally the depth was about 13 feet. The original depth over Bulkhead shoals was less than 4 feet.

The original project, adopted June 14, 1880, provided for dredging a channel 100 feet wide and 11 feet deep through the bar at the mouth of the river, the width of cut to be increased to 200 feet if the results justified this enlargement.

This project was amended September 19, 1890, to include dredging a channel 9 feet deep and not less than 100 feet wide across the Bulkhead shoals.

Upon this project as amended has been expended $154,000, of which $100,000 has been applied to maintenance in repeated dredging of the cut across the bar at the mouth of the river. The channel through Bulkhead shoals, dredged in 1891–2, remains practically unchanged, with a minimum depth of 8 feet at mean low water.

Prior to the adoption of any project of record in this office $28,600 was expended on this improvement—1833–1839—but the object and results of such expenditures are unknown.

By act approved March 3, 1899, a new project was adopted, which provided for a channel 100 feet wide, 18 feet deep at mean low water, through the West Pass along the northern shore of St. George Island and across the bay to the water front of Apalachicola, estimated to cost $350,000, and $20,000 or $30,000 annually for maintenance of completed work.

The amount expended on this project was $130,679.26, of which about $90,000 was for maintenance.

By act of Congress, approved March 2, 1907, a new project was adopted by which the previous project was amended so as to provide for a channel across the bar at the mouth of the Apalachicola River not less than 100 feet wide and 10 feet deep at mean low water and a channel not less than 150 feet wide and 18 feet deep through Link channel and West Pass to the Gulf of Mexico, at an estimated cost of $85,000, and $17,500 annually for maintenance after completion.

During the year the channel 10 feet deep and 100 feet wide across the bar at the mouth of the river has been completed, and for its protection from westward-moving silt a bulkhead is being built to the east of this channel. This bulkhead is to be 6,900 feet long, 6,000 feet of which had been completed with the close of the fiscal year. About 70 per cent of the project is completed.

The amount expended on this project up to the close of the fiscal year ending June 30, 1908, was $64,459.24, of which $10,000 was for maintenance of project of 1899.

The hurricane of September 26–27, 1906, seriously damaged the channel across the outer bar at West Pass by extending the shoal at the western end of Sand Island across the dredged cut, filling it and forcing this part of the channel farther to the west.

The ordinary range of the tide is about 2 feet.

The commerce of this port is in timber, cotton, naval stores, staves, a large quantity of dressed and kiln-dried lumber, shingles, laths, and miscellaneous freight, and for the year ending June 30, 1908, it is estimated at a valuation of $600,000.

On June 30, 1908, the maximum draft that could safely be carried through the West Pass entrance to the lower anchorage behind St. George Island was about 16 feet and the maximum draft that could be carried across the bar at the mouth of the river was about 7 feet.

Reference to reports on examinations and surveys of this harbor will be found on pages 335 and 355 of Report of the Chief of Engineers for 1906.

It is proposed to apply the appropriation asked for to maintenance to make the improvement available.

The portion of the project now completed gives greatly increased facilities to the commerce of this port and a substantial reduction in freight rates on coastwise commerce. The exact amount of this reduction and the reduction on foreign commerce can not yet be stated.

July 1, 1907, balance unexpended	$84,820.74
June 30, 1908, amount expended during fiscal year for works of improvement	64,459.24
July 1, 1908, balance unexpended	20,361.50
July 1, 1908, outstanding liabilities	10,856.91
July 1, 1908, balance available	9,505.59
July 1, 1908, amount covered by uncompleted contracts	9,504.00
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	80,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix Q 2.)

3. Apalachicola River, Florida, including the Cut-off and Lower Chipola River, Florida, and the Upper Chipola River from Marianna to its mouth.—(a) *Apalachicola River, the Cut-off and Lower Chipola River.*—From the junction of the Chattahoochee and Flint rivers to the Gulf of Mexico (Apalachicola Bay) the Apalachicola River has a length of about 137 miles and a low-water slope of about 3 inches to the mile. The width varies from 150 to 300 yards and the available depth was originally 6 feet at low water, except where obstructed by snags and sunken logs.

The Confederate authorities obstructed the channel at a point about 47 miles above the mouth, causing the river to break through by a channel known as Moccasin Slough into the River Styx, the latter a tributary entering the Apalachicola a few miles below the Confederate obstructions. Moccasin Slough was very narrow and tortuous and much obstructed by logs, snags, etc., and the former channel has gradually filled up.

About 55 miles above the mouth steamboats may leave the river and after passing through the Cut-off, Lower Chipola River, and Lee Slough, reenter it about 17 miles farther down, thus making many landings of much greater importance than those upon the corresponding part of the main river, which includes Moccasin Slough above mentioned.

The original project adopted by the act of June 23, 1874, contemplated securing a channel 100 feet wide and 6 feet deep at low water by the removal of snags and overhanging trees and widening and straightening Moccasin Slough and the Elbows, at an estimated cost of $80,333.

The act of September 19, 1890, adopted an addition to the project, providing for the clearing of a channel 60 feet wide and 5 feet deep through the Cut-off, Lee Slough, and the Lower Chipola River, at a cost of $7,500.

The amount expended on work under this project since 1871 to the close of the fiscal year ending June 30, 1908, was $96,506.58. In

addition there was expended between 1828 and 1831, $13,000, for which no project is of record. These expenditures have improved Moccasin Slough sufficiently for present purposes and maintained the river reasonably free from snags and other obstructions and enabled steamboats to make use of the Cut-off, Lower Chipola River, and Lee Slough either by day or night. An available depth of 6 feet has been secured in the Apalachicola River and 5 feet in the Cut-off, Lower Chipola River, and Lee Slough. The Cut-off and Lee Slough have been widened also at the narrowest places so that steamboats can pass through readily going downstream and can pass upstream with little difficulty, but the channel in Lee Slough is still very crooked, with some sharp bends that require easing, and the steamboats prefer the main river on the up trip. It is estimated that the project is about 70 per cent completed.

The work was done with the plant belonging to the Chattahoochee and Flint river improvements, and comprised cutting overhanging timber, removing snags and logs, blasting out cypress stumps, and widening the slough and Cut-off by clearing the points of timber and dredging them off, depositing the dredged material in the deep holes or upon the banks.

During the fiscal year work has been confined to the maintenance of the improvement and a small amount of permanent work in the Cut-off and Lee Slough.

Variation of the water level is from 0 to 30 feet at Chattahoochee River bridge.

This river is navigable throughout its entire length of 137 miles.

As the country bordering on the Apalachicola River is almost entirely dependent upon the river for the transportation of its supplies and products, this improvement is essential to the development of this section, but in the absence of any basis of comparison the effect upon freight rates can not be determined.

It is proposed to apply the available balance and the funds recommended to maintenance of Apalachicola River proper by removing annual accumulation of snags, and to continue straightening and widening the Cut-off as above to make the improvement available.

The commerce of the river consists chiefly of cotton, naval stores, general merchandise, saw logs, and timber for export, and is so combined with that of the Chattahoochee, Flint, and Upper Chipola rivers that a separation is impossible. The commerce of all these streams has increased from about $4,000,000 in 1899 to about $10,000,000 in 1908. For detailed statistics see report on Flint River improvement.

For reference to reports of examinations of this river see Report of the Chief of Engineers for 1906, page 337.

(*b*) *Upper Chipola River, Florida, from Marianna to its mouth.*—The river from Marianna to the head of the Dead Lakes has a general low-water depth of 5 feet and width varying from 60 to 200 feet, but is greatly obstructed by rock shoals, snags, and overhanging trees. Three bridges also form obstructions, their headways above low water being 17, 16 and 15 feet, respectively.

At Look and Tremble shoal, about 45 miles above the Dead Lakes, there is a fall of 5 feet in 40 over rock bottom. At Sister Islands, between this shoal and the Dead Lakes, the main channel of the river is very tortuous and obstructed by mud bars over which there is less

than 2 feet at low water. The channel through the Dead Lakes, which is considered part of this improvement, has plenty of water, but is obstructed by snags and large cypress stumps and trees.

The approved project, adopted by act of March 3, 1899, provides for clearing a low-water channel 3 feet deep and 60 feet wide from Marianna to the foot of the Dead Lakes, estimated to cost $41,000, exclusive of necessary plant, which would comprise a snag boat, drilling barge, and dump scow.

The amount expended to June 30, 1908, was $16,411, of which $5,000 was applied to the river above Sister Islands and $11,411 to the lower end of Dead Lakes. Snags, logs, and overhanging trees were removed, and a channel blasted through the rock reefs from Marianna to Look and Tremble shoal. Wing dams were built below some of the shoals to raise the water level on the shoals, and below Look and Tremble shoal, down as far as Sister Islands, snags, logs, and overhanging timber were removed as well as available funds permitted. From the lower end of the Dead Lakes for a distance of 35 miles a channel 60 feet wide was cleared of obstructions by removing logs, overhanging trees, cypress stumps, and knees. Very little benefit has been derived from the expenditure above Look and Tremble shoal, except to timber industry, but the work done below the shoal and in the Dead Lakes has been of great benefit, as there are many turpentine stills below this shoal, giving a considerable commerce on this portion of the river and in the Dead Lakes a large commerce in towing logs.

The variation of the water level is 0 to 14 feet.

Two feet is the maximum depth at low water over the shoalest part of the river below the shoal Look and Tremble. The actual head of navigation at low water is Sister Islands, 35 miles above the foot of the Dead Lakes.

The river is still obstructed by shoals at Sister Islands, Look and Tremble shoal, and at numerous points above, as well as by the bridges mentioned; also by snags and overhanging trees just below Sister Islands and at various points above.

About 30 per cent of the project is completed.

The commerce of this stream consists principally of naval stores, round and square timber, lumber, and other miscellaneous freights, the estimated value of which was, on June 30, 1908, $100,000.

The section of country below Look and Tremble shoal has no railroad and depends largely upon this river, the reduction in freight rates being the lessened haul to river as compared to Apalachicola River or railroads to the north and west.

It is proposed to apply the available balance and the funds recommended to dredging and regulation of channel at Sister Islands bar and to removal of snags and overhanging trees in remainder of river. This work is necessary to make the improvement available.

The territory through which this stream flows is heavily timbered with long-leaf yellow pine and cypress, which is now being rafted down this stream in large quantities. The total amount of this traffic is reported as 10,000,000 feet B. M. per annum, and is included in the valuation of timber and lumber exports for Apalachicola Bay and Carrabelle, Fla.

For reference to report of examination of this stream, see Report of the Chief of Engineers for 1906, page 338.

APALACHICOLA RIVER.

July 1, 1907, balance unexpended	$1,000.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	22.50
July 1, 1908, balance unexpended	977.50
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

LOWER CHIPOLA RIVER.

July 1, 1907, balance unexpended		$13,711.24
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$1,500.00	
For maintenance of improvement	6,945.32	
		8,445.32
July 1, 1908, balance unexpended		5,265.92
July 1, 1908, outstanding liabilities		1,625.84
July 1, 1908, balance available		3,640.08
Amount (estimated) required for completion of existing project		5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

UPPER CHIPOLA RIVER.

July 1, 1907, balance unexpended	$7,501.00
June 30, 1908, amount expended during fiscal year for works of improvement	3,912.00
July 1, 1908, balance unexpended	3,589.00
July 1, 1908, outstanding liabilities	79.34
July 1, 1908, balance available	3,509.66
Amount (estimated) required for completion of existing project	30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

[a] See consolidated money statement on page 377.

CONSOLIDATED.

July 1, 1907, balance unexpended		$22,212.24
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$5,412.00	
For maintenance of improvement	6,967.82	
		12,379.82
July 1, 1908, balance unexpended		9,832.42
July 1, 1908, outstanding liabilities		1,705.18
July 1, 1908, balance available		8,127.24
Amount (estimated) required for completion of existing project		35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance in addition to the balance unexpended July 1, 1908		20,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix Q 3.)

4. *Flint River, Georgia.*—Originally this river was navigable at low water from its mouth to Bainbridge, a distance of 36 miles, for boats drawing 3 feet, but the channel was narrow, crooked, and greatly obstructed by logs, snags, and overhanging trees. Above Bainbridge the channel was so obstructed by rock shoals, loose rock, and bowlders that there was no navigation except on a rise of 5 feet, when steamboats could run to Albany, 105 miles above the mouth. Above Albany to Montezuma, 182 miles from the mouth, the channel was so obstructed by sand and rock shoals, bowlders, snags, logs, and overhanging trees that the river was not navigable at a low-water stage.

The original project called for a channel 100 feet wide and 3 feet deep at extreme low water from the mouth of the river to Albany, Ga., at an estimated cost of $184,862.

This project was extended in 1879 to give a channel for light-draft steamers at moderate stages of water from Albany to Montezuma by the removal of logs, snags, and overhanging trees, cutting through rock reefs, and deepening sand bars by contraction works, at an additional cost of $15,000.

The amount expended up to the close of the fiscal year ending June 30, 1908, was $271,361.82, practically all being for permanent work. As a result of the work done, the river is now navigable throughout the year from Albany down to a point about 7 miles below Newton, 40 miles, and from Bainbridge to the mouth, 36 miles, there being a good channel with 3 feet available at low water throughout these sections. The project is about 65 per cent completed.

Between Bainbridge and Newton, for a distance of 29 miles, the river is navigable for light-draft boats only, and the channel is narrow and still much obstructed by bowlders and rock reefs. Considerable work has been done between these points, and operations for the next few years will be confined to this portion of the river. When the improvement of this section has been completed the river will be open to navigation at low water from its mouth to Albany, Ga.

The section between Albany and Montezuma, 77 miles, is still much obstructed, although it has been repeatedly cleared of snags and similar obstructions in accordance with the project.

The water level varies from 0 to 40 feet.

During ordinary low water Albany, Ga., is the head of navigation, but in periods of extreme low water, such as occurred during the fall of 1904, interruptions occur in the section between Bainbridge and Newton.

The commerce consists principally of cotton, naval stores, provisions, general merchandise, saw logs, and timber for export. Several very large sawmills are located at Bainbridge, but no record of the amount of lumber manufactured is kept, as shipments are made by rail. A large part of the saw logs used by these mills comes down the river.

It is proposed to apply the available balance and the funds recommended toward making the improvement below Albany fully available by widening the channel in many places between Bainbridge and Newton, and removing many obstructions to secure the width of 60 feet and the depth of 3 feet now available in the section above.

This work is largely permanent rock work, and its completion will greatly benefit the section of country between Albany and the mouth of the river. There are many turpentine stills in operation on the river which depend upon the water transportation for their products and supplies.

The effect of the improvement on freight rates, if any, can not be determined.

The commerce of the lower part of this stream is so combined with that of the Chattahoochee and Apalachicola rivers that it is impossible to give a statement in regard to it. The commerce of that part below Albany down as far as the improvement has been carried is estimated to be 13,145 tons, valued at $1,182,585, for the year ending December 31, 1907.

For reference to reports of examination of this improvement, see Report of the Chief of Engineers for 1906, page 340.

July 1, 1907, balance unexpended	$29,419.58
June 30, 1908, amount expended during fiscal year for works of improvement	19,781.40
July 1, 1908, balance unexpended	9,638.18
July 1, 1908, outstanding liabilities	2,179.13
July 1, 1908, balance available	7,459.05
Amount (estimated) required for completion of existing project	62,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	25,000.00

(See Appendix Q 4.)

5. *Chattahoochee River, Georgia and Alabama, below Columbus.*—Columbus, Ga., is 223 miles above the junction of this river with the Flint and 360 miles above the mouth of the Apalachicola River, formed by the confluence of the Chattahoochee and Flint. Originally boats were always able to reach Columbus, but navigation was difficult and dangerous by day and impossible by night, owing to the large accumulation of logs, snags, and overhanging trees, and to sand, rock, and marl shoals obstructing the channel.

The project for the improvement, adopted in 1873, provided for a low-water channel 100 feet wide and 4 feet deep from Columbus, Ga., to Chattahoochee, Fla., at the junction of the Flint, which was to be obtained by the removal of logs, snags, and overhanging trees, cutting through the rock and marl shoals, and scouring out sand bars by works of contraction and shore protection. The estimated cost of this work from Chattahoochee, Fla., to Eufaula, Ala., 139 miles, was $145,247, but no estimate of cost for that part between Eufaula and Columbus was ever made.

The amount expended on this work to the close of the fiscal year ending June 30, 1908, was $641,734.28, largely expended in maintenance, removing the annual influx of obstructions brought in from caving banks. The project is about 70 per cent completed in the upper section, above Eufaula, and about 10 per cent in the lower section.

No increased depth, except in the upper part of the river, has been gained; but by removing the logs, snags, and overhanging trees, removing the sand, gravel, marl, and rock reefs and regulating the channel immediately below Columbus, the river has been kept open to navigation. As nearly all the land along the banks of the river and its tributaries has been gradually cleared, each rainy season has brought increasing quantities of sand into the river, filling the original river bed with shifting sand and gravel bars and greatly changing its regimen. Four feet draft can be carried at ordinary low water, but at extreme low water scant 3 feet is the maximum draft that can be counted upon.

Below Eufaula, Ala., the river is now in a fair condition, with an available low-water depth of 3½ feet, but between Eufaula and Columbus there are a number of bars and isolated obstructions which cause trouble, particularly at extreme low water. The most serious of these obstructions was a series of sand bars, formed in the river from the wharves at Columbus down to Mary Freemans bar, 3 miles below, which made it impossible for steamboats to reach Columbus, and the head of navigation during the period of extreme low water was therefore Mary Freemans bar.

During the last few years more liberal appropriations have permitted a more vigorous prosecution of work, and considerable progress has been made on the permanent improvement of the river. In addition to maintaining the river free from snags and obstructions, the channel for a distance of 24 miles below Columbus has been regulated by a system of jetties, and the most serious bars in the upper river have been kept open by dredging where necessary. As a result of this work, Columbus has become the head of navigation, and boats are able to reach there at all times, except during unusually low water, such as occurred in the fall of 1904, putting a stop to all navigation.

A large number of other sand bars and shoals between Columbus and Eufaula still need improvement, the regulating works already built require repairs and maintenance, and the annual accumulation of snags and other obstructions must be removed from the river throughout its length.

It is proposed to apply the funds available and the appropriation recommended to this work, the regulating works to be extended down the river from the foot of the present permanent improvement.

The variation of the water level is 0 to 47 feet at Columbus.

The commerce of this stream consists of cotton, cotton seed, fertilizers, grain, naval stores, provisions, hardware, and general merchandise, and is so combined with that of the Flint and Apalachicola rivers that a separation is impossible. It is given under the report of the Flint River as 115,839 tons, valued at $10,000,000.

The effect of improvement has been to give to Columbus and all other points on the river water rates, or a material reduction over rates to all rail points, but the exact amount of reduction can not be stated.

For reference to report of examination of this river see Annual Report of the Chief of Engineers for 1906, page 341.

July 1, 1907, balance unexpended		$151,654.62
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$45,000.00	
For maintenance of improvement	25,458.12	
		70,458.12
July 1, 1908, balance unexpended		81,196.50
July 1, 1908, outstanding liabilities		5,692.77
July 1, 1908, balance available		75,503.73
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		230,000.00

(See Appendix Q 5.)

6. *Choctawhatchee River, Florida and Alabama.*—The Choctawhatchee River is 162 miles long from Newton, Ala., to its mouth, in Choctawhatchee Bay, an arm of the Gulf of Mexico.

Originally the river was impassable during low water for about 10 miles below Newton, due to marl reefs and fish-trap dams, and for the remaining 152 miles to the mouth it was much obstructed by snags, logs, overhanging trees, and sand and gravel bars.

The project for the improvement, as amended in 1890, contemplates the creation of a low-water navigable channel throughout by removing logs, snags, and overhanging trees, by excavating rock and marl shoals, and by contraction works and shore protection, at an estimated cost of $112,832.

The amount expended on this river under the existing project (i. e., since 1874) up to the close of the fiscal year ending June 30, 1908, was $182,430.57, of which the greater part has been expended in maintenance. The expenditures prior to 1874 amounted to $12,876.62.

The project has been completed and the additional work required is for maintenance.

The following results have been accomplished:

A channel 40 feet wide and 3 feet deep has been blasted through the marl shoals below Newton to the lower end of these shoals above Pates Landing. The river has been partially cleared of snags and other obstructions from Pates Landing to Geneva, but above Pates Landing to the foot of the shoals it is impassable at lower stages of water. A fairly navigable channel 3½ feet deep at low water

was secured by snagging and works of regulation from Geneva to Caryville, but is again much obstructed. The remainder of the lower river has repeatedly been cleared of obstructions, but is at present much obstructed, except the section below the mouth of the Holmes River, which is in fair condition. A channel 75 feet wide and 6 feet deep at mean low water was dredged through the bar at the mouth of the river (Cypress Top).

The actual head of navigation at low water on June 30, 1908, was the mouth of the Holmes River, 33 miles above the mouth of the river. The minimum draft that could be carried to this point was about 3 feet, but the draft is at least 1 foot greater, except at Sandy reach, where trouble has recently developed.

The effect of the improvement on freight rates, if any, can not be stated.

The additional appropriation recommended will be applied to removal of obstructions for maintenance of improvement below Geneva.

There is no commerce on the river above Geneva, with the possible exception of a small movement of logs. Below Geneva there is a large commerce in logs and hewn timber, and five steamers ply between Pensacola and Vernon on the Holmes River.

The commerce on this stream is mainly saw logs, timber, naval stores, and general merchandise, estimated at $2,500,000 in value.

For reference to reports on examination of this river, see Annual Report of the Chief of Engineers for 1906, page 343, and page 392 of this report.

July 1, 1907, balance unexpended	$9,699.62
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,830.19
July 1, 1908, balance unexpended	5,869.43
July 1, 1908, outstanding liabilities	221.66
July 1, 1908, balance available	5,647.77
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix Q 6.)

7. Holmes River, Florida, from Vernon to its mouth.—Holmes River empties into the Choctawhatchee River about 40 miles above the mouth of the latter. It is a wide and deep stream to the town of Vernon, 25 miles above its mouth, but was originally obstructed by sunken logs, fallen timber, and overhanging trees, and was only available for navigation by small sailing craft and barges, which occasionally made trips up to Vernon.

The present project for the improvement of the stream provides for making a navigable channel by removing logs and snags from the river and overhanging trees from its banks, from the mouth up to the town of Vernon.

The total amount expended on this improvement up to the close of the fiscal year ending June 30, 1908, was $15,321.75, of which $13,160.95 was upon Holmes River and $2,160.80 upon Lagrange Bayou.

The project has been completed and additional work required is for maintenance.

The operations during the year consisted in snagging for maintenance of the channel to Vernon, the head of navigation.

The importance of this improvement has greatly increased in the last few years, and five steamers are now engaged in the large and growing trade between Vernon and Pensacola.

The commerce of the stream consists of cotton, turpentine, rosin, molasses, honey, and miscellaneous articles, the value of which in 1908 was $1,000,000.

For reference to report of examination of this stream, see Report of the Chief of Engineers for 1882, page 1308.

As this river is the only means of transportation in that section, there is no basis for comparison and the effect of the improvement on freight rates can not be stated.

July 1, 1907, balance unexpended	$2,000.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,321.75
July 1, 1908, balance unexpended	678.25
July 1, 1908, outstanding liabilities	473.94
July 1, 1908, balance available	204.31
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	2,000.00

(See Appendix Q 7.)

8. Blackwater River, Florida.—The original project for this improvement was adopted March 3, 1899, and provided for securing a channel 9 feet deep from Milton, Fla., to Pensacola, Fla., at an estimated cost of $20,000. Under this project $5,000 was expended, and a channel of the required depth secured in the river proper.

The river and harbor act of March 3, 1905, fixed the width of the channel at 100 feet and the estimated cost of completion at $15,000.

With funds appropriated by this act an 8-inch suction dredge and other plant necessary for doing the work were repaired and dredging was commenced in East Bay near the beacon, about 2 miles below Robinsons Point, and a channel about 80 feet wide and not less than 9 feet deep was dredged for a distance of 4,470 feet toward Robinsons Point. This cut has improved the worst part of the channel and increased the available depth over the improvement about 1 foot, and it is estimated that the approved project is about 40 per cent completed. In the execution of this work it has been found that the area to be dredged over is much larger than indicated by the available charts of the improvement, possibly due in part to fill which has taken place since the surveys for the charts were made. To secure a channel 9 feet deep and 100 feet wide over the remaining shoals within the wide limits covered by the improvement is estimated to require $20,000 in addition to funds available. It is to be noted that in the report upon which the present project is based the doubtful character of the original estimate was recognized and the possibility of a considerable increase was clearly foreseen.

The total amount expended on this improvement up to the close of the fiscal year ending June 30, 1908, was $19,729.97, of which about $5,000 was for maintenance. The expenditure during the year was in payment of outstanding liabilities of the preceding year and incidental expenses.

The maximum draft that could be carried over the improvement at mean low water on June 30, 1908, was 8 feet. The usual variation of water surface is 2 feet. The head of navigation is at Milton, about 4 miles above the mouth of the river proper.

The effect of the improvement on freight rates, if any, can not be stated.

It is proposed to apply the additional appropriation recommended to completion of the project and its maintenance thereafter.

The commerce of this stream consists of timber, lumber, sash and doors, naval stores, wool, and general merchandise, having an estimated value of $1,350,000 per annum. The dry dock at Bagdad and marine railway at Milton both do a large business, which would be materially increased by the completion of the project.

For reference to report of examination of this improvement, see Annual Report of the Chief of Engineers for 1906, page 345.

July 1, 1907, balance unexpended	$3,629.02
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,358.99
July 1, 1908, balance unexpended	270.03
July 1, 1908, outstanding liabilities	31.82
July 1, 1908, balance available	238.21
Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	25,000.00

(See Appendix Q 8.)

9. Harbor at Pensacola, Fla.—The available depth across the inner bar at the entrance to this harbor in 1879, previous to any work of improvement, was 19.5 feet, the width of the channel being contracted by the encroachment of the Middle Ground shoal to the southward. The harbor entrance and channel way were also obstructed by wrecks, and the western shore line in the vicinity of Fort McRee was cutting away rapidly, almost the whole of the old Fort McRee washing away before the erosion was stopped.

The project of 1877 considered only the removal of the wrecks; that of 1878 called for the removal of these wrecks and for making a survey to determine further recommendations for improvement. The project of 1881 provided for dredging a channel 300 feet wide and 24 feet deep at mean low water for the temporary relief of navigation, and also for protecting the shore line near Fort McRee, with a view to preventing further injurious changes. Dredging under this project was carried on at various times between 1881 and 1893, and at the close of the dredging operations in August, 1893, the available channel was 225 feet wide and 24 feet deep at mean low water. Two

groins, one 360 feet and the other 220 feet long, were completed in 1890 and still serve to hold the shore line near Fort McRee.

In 1891 a special Board of Engineers presented a project for opening a new channel across the Caucus shoal, following the direction of the ebb current, by means of two jetties, assisted by dredging, if necessary. In 1895 a second special Board of Engineers recommended that no change be made in the project of 1891, but that dredging be tried, using one of the hydraulic dredges belonging to the United States to open up a channel 26 feet deep at mean low water and as wide as practicable on the line of deepest water across the Caucus shoal and approximately on the line of the axis of the jettied channel proposed by the Board of Engineers in 1891. In December, 1895, this channel was opened by the U. S. dredge *Gedney* to a width of 120 feet and depth of 24 feet at mean low water. It has a length of about 10,000 feet across Caucus shoal and is now known as the Caucus channel.

In 1896 the same Board that recommended the first amendment to the project of 1891 submitted a second amendment providing for the expenditure of all funds available in continuing the work of dredging across the Caucus shoal and for building a dredge and opening the channel across the Caucus shoal 30 feet deep at mean low water to a width of at least 300 feet, with such side slopes as the material would assume, if sufficient funds were made available by Congress. Until a channel should be opened by dredging across the Caucus shoal, as above proposed, the Board recommended that the construction of the jetties for its maintenance be not considered.

The river and harbor act of March 3, 1899, extended this project to "securing a channel depth of 30 feet at mean low water, from the Gulf of Mexico to the dock line at the east end of the city of Pensacola."

The amount expended on these projects to June 30, 1905, was $725,956.94. The work done comprises the removal of the wrecks obstructing the channel, dredging a large amount of material from the inner bar, opening and redredging a 30-foot channel across the Caucus shoal, and the protection of the shore line from erosion by the construction of two groins near old Fort McRee.

The river and harbor act approved June 13, 1902, appropriated $220,000, of which $150,000 might be used in constructing a seagoing suction dredge. This dredge, the *Caucus*, was built and turned over to the district in August, 1905. The same act modified the project, which now provides for dredging a channel 30 feet deep and 500 feet wide from the Gulf of Mexico to the dock line at the east end of the city of Pensacola. There is no approved estimate of the cost of this project. Under this amended project there has been expended for dredge construction $172,221.27 (for particulars see Appendix H 9), and for the improvement, $224,024.15, of which about $150,000 has been applied to maintenance.

There was received for salvage work of the dredge *Caucus*, $4,752.44, and from sale of unserviceable property, $26.77.

The project is about 30 per cent completed.

The dredge *Caucus* commenced dredging September 18, 1905, and at the close of the present fiscal year had removed a total of 1,467,083 cubic yards of material. This work has restored the channel to its

original dimensions and widened it about 125 feet, and removed the shoaling due to the storm of September, 1906, so that on June 30, 1908, the minimum width of channel having a depth not less than 30 feet at mean low water was approximately 275 feet.

From October 6, 1906, to January 8, 1907, inclusive, the *Caucus* was employed by the Navy Department on salvage work at the Pensacola Navy-Yard, resulting from the storm of September 26–27, 1906, and upon completion of this service she was laid up at the navy-yard for repairs. Due to crippled facilities and lack of labor at the yard, these repairs were greatly delayed, and dredging was not resumed until May 11, 1907, when the *Caucus* commenced work with one pump, pending completion of repairs to boilers. These repairs were completed and work resumed with both pumps on July 25, 1907, since which time work has been continuous, except for delays due to bad weather and repairs. These repairs include docking at Mobile, Ala., installing new propeller, and one new furnace.

The maximum draft that could be carried over the improvement at mean low water on June 30, 1908, was 30 feet, and the ordinary range of the tide is about 1.1 feet.

The commerce of this port is very large. For the fiscal year ending June 30, 1903, the foreign exports were reported as $13,741,540, no record of the coastwise exports being available; in 1904, as $15,893,456; in 1905, exports as $15,295,067, and imports as $985,840; in 1906, exports as $18,432,931, and imports as $386,377; in 1907, exports as $20,229,414, and imports as $618,363; in 1908, exports as $20,322,649, and imports as $675,503.

The completion of the project will give greatly increased facilities to the large commerce of Pensacola, but will not materially affect freight rates.

It is proposed to apply the appropriation recommended in dredging operations toward completion of the project and maintenance of the project depth.

July 1, 1907, balance unexpended		$106,275.97
Received for salvage work by dredge *Caucus*		4,752.44
Received from sale of old property		26.77
		111,055.18
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$20,000.00	
For maintenance of improvement	51,879.19	
For construction of dredge *Caucus*	842.88	
		72,722.07
July 1, 1908, balance unexpended		38,333.11
July 1, 1908, outstanding liabilities		9,649.60
July 1, 1908, balance available		28,683.51
July 1, 1908, amount covered by uncompleted contracts		3,820.70
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		150,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix Q 9.)

10. Escambia and Conecuh rivers, Florida and Alabama.—These two names apply to one and the same stream, which flows through a heavily timbered country in southern Alabama and western Florida into Escambia Bay, an arm of Pensacola Bay. The change of name occurs at the boundary line between the two States. The timber from this district is brought down the river and forms a large part of all that is exported from Pensacola. Originally the river was much obstructed by snags, marl reefs, and sand bars, and a bar at its mouth, where the rafts are made ready to be towed to Pensacola, prevented the entrance of tugs and seriously interfered with navigation.

The first appropriation for the improvement of this river was made in 1833, and prior to the adoption of the present project $5,000 was expended in removing obstructions. A subsequent appropriation of $5,500, made in 1836, was returned to the surplus fund in 1838. No further appropriations were made until 1880.

(*a*) *General improvement.*—The present project, as originally adopted June 14, 1880, provided for the improvement of the river from its mouth to Indian Creek, Alabama, an estimated distance of 293 miles, by the removal of snags, logs, and overhanging trees, by excavating rock shoals, by works of contraction and shore protection, and by dredging a channel 150 feet wide and 5½ feet deep at mean low water through the bar at the mouth, all at an estimated cost of $87,430, but the recent adoption of a separate project for the Conecuh River has, in effect, fixed the upper limit of the improvement as the mouth of Patsaliga Creek. The project has been completed and additional work required is for maintenance.

The amount expended on this project to June 30, 1908, was $135,567.81, largely for maintenance. These expenditures have kept the river fairly free from snags, opened the channel across the bar at the mouth from time to time, and greatly facilitated the rafting and towing of timber; but, due to lack of funds in recent years, the river, which in 1900 was practically free from obstructions from its mouth to near the mouth of Patsaliga Creek, has again become so much obstructed as to seriously interfere with the rafting of timber at low-water stages. The channel across the bar has shoaled also, interfering with the movement of the towboats for the rafts.

During the year the channel was dredged across the bar at the river mouth and the stream cleared of obstructions for a distance of 86 miles.

It is proposed to apply the appropriation recommended in snagging and dredging toward maintenance of the improvement.

Reference to reports of examination of this improvement will be found on pages 348 and 349 of the Report of the Chief of Engineers for 1906.

(*b*) *Conecuh River.*—By act of Congress, approved March 2, 1907, a project was adopted for completing the improvement of the Conecuh River from the mouth of Patsaliga Creek to the State line between Florida and Alabama by removal of bowlders, snags, and rock shoals, in accordance with report submitted in House Document No. 159, Fifty-ninth Congress, first session, at an estimated cost of $31,000.

For work under this project a plant consisting of a quarter boat and two working barges have been constructed. The field work commenced July 22, 1907, and funds now available will be sufficient to complete the project for this section of river. Subsequent maintenance can be more conveniently and logically provided for under the general project.

The actual head of navigation during ordinary stages of the river is at the mouth of Patsaliga Creek, about 195 miles above the mouth of Escambia River.

The effect of the improvement on freight rates, if any, is not known.

The commerce of this stream is mainly in timber, lumber, and saw logs, the value of which is estimated at $2,500,000.

GENERAL IMPROVEMENT.

July 1, 1907, balance unexpended	$17,965.98
June 30, 1908, amount expended during fiscal year for maintenance of improvement	10,052.12
July 1, 1908, balance unexpended	7,913.86
July 1, 1908, outstanding liabilities	738.65
July 1, 1908, balance available	7,175.21
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

CONECUH RIVER.

July 1, 1907, balance unexpended	$30,035.80
June 30, 1908, amount expended during fiscal year for works of improvement	8,517.47
July 1, 1908, balance unexpended	21,518.33
July 1, 1908, outstanding liabilities	557.22
July 1, 1908, balance available	20,961.11

(See Appendix Q 10.)

11. Alabama River, Alabama.—This river is formed by the junction of the Coosa and the Tallapoosa, 11 miles below Wetumpka, on the Coosa River, and from this junction to its junction with the Tombigbee to form the Mobile it constitutes a 312-mile link in a waterway 815 miles long, from the Oostenaula and Coosawattee rivers, Georgia, to the Gulf of Mexico.

The river was originally so obstructed by logs, snags, and overhanging trees, and shoals, many with depths of but 2.5 feet, that during the low-water season navigation was practicable by day only. Long detentions were frequent at many of the shoals below Selma, and when the water was unusually low traffic was suspended between Selma and Montgomery for three or four months in the year.

The original project, adopted in 1878, for the improvement of this stream provided for securing a low-water channel 4 feet deep and

200 feet wide by removing snags, logs, and overhanging trees; by constructing works of regulation, and by dredging, all at an estimated cost of $229,741. On this project $185,000 was expended, principally in snagging operations and the construction of works of contraction. These expenditures greatly improved the condition of the channel, freeing it from obstructions, and secured a low-water depth of 4½ to 5 feet.

In 1891 the original project was amended to provide for a low-water channel 6 feet deep, which was to be secured in the same general way as contemplated in the original project, and the estimated cost was placed at $386,251, provided that at least $100,000 should be appropriated annually, and $10,000 a year thereafter for maintenance. The project is about 20 per cent completed.

Upon this project there has been expended to June 30, 1908, $363,-660.78, largely for maintenance, but until recently appropriations have been very small and the channel has been deteriorating, work on the river being confined to the operations of the snag boat. During the last two years the plant has been thoroughly overhauled and materially increased, and both the dredge and snag boat operated throughout the working seasons. Fifty dollars was received from sale of unserviceable property.

The river and harbor act of March 3, 1905, contemplated securing a continuous channel not less than 4 feet deep in the Alabama River by open-channel work, and as the benefits to be derived from the improvement are very great, funds should be provided for the vigorous prosecution of work.

Operations during the year consisted in snagging, dredging, and construction of contraction works at various points.

On June 30, 1908, the maximum draft that could be carried to Montgomery at low water was about 3½ feet, but as the boats operating on this river draw from 4 to 6 feet the shoaling at Haines Island prevented them from passing above this point for about three weeks. It is proposed to apply the appropriation recommended in snagging. dredging, and construction of contraction works in furtherance of the project and in maintenance of the improvement.

The actual head of navigation is Wetumpka, on the Coosa River, and the variation of the water level is from 0 to 59 feet at Montgomery.

The commerce of this stream is important, consisting principally of cotton, cotton seed, fertilizer, grain, lumber, shingles, naval stores, staves, and a large quantity of miscellaneous freight of all descriptions, amounting in the past calendar year to approximately 341,628 tons, valued at $3,886,565. This, however, is but a part of the freight movement that is affected by the improvement, for the actual shipments by water have been relatively small, and, with the river improved for continuous navigation, it is estimated that at least 100,000 tons of the present all-rail freight movement would either go by river or at river rates, and the resulting saving would be enormous. In addition, improved facilities would render possible an actual reduction in rates on freight now carried by river.

For reference to reports of examinations made of this river, see Report of the Chief of Engineers for 1906, pages 349 and 350.

July 1, 1907, balance unexpended		$230,340.94
Amount received from sale of boilers		50.00
		230,390.94
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$45,001.72	
For maintenance of improvement	15,000.00	
		60,001.72
July 1, 1908, balance unexpended		170,389.22
July 1, 1908, outstanding liabilities		36,001.12
July 1, 1908, balance available		134,388.10
July 1, 1908, amount covered by uncompleted contracts		26,541.68
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		200,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix Q 11.)

12. Coosa River, Georgia and Alabama.—The Coosa is formed at Rome, Ga., by the junction of the Oostenaula and Etowah rivers, which have their sources in northern Georgia. The Oostenaula is formed by the junction of the Coosawattee and Connesauga rivers, 56 miles northwest of Rome. The Oostenaula above Rome, Ga., and its tributary, the Coosawattee, are navigable for light-draft boats during nine months of the year for a distance of about 105 miles, but the Etowah and the Connesauga are not navigable.

The Coosa River has always been navigable for light-draft boats from Rome, Ga., to Greenport, Ala., an estimated distance of 162 miles, and this part of the river is of such a character as to make its improvement by works of contraction and channel excavation entirely practicable, except at Horseleg shoals, near Rome, Ga., where a lock of low lift will be ultimately required.

From Greenport, Ala., to Wetumpka, Ala., a distance of 142 miles, locks and dams are required in conjunction with works of contraction and channel excavation to provide for navigation.

From Wetumpka to the junction of the Tallapoosa River the river is navigable at all seasons.

The ordinary variations of the water surface are, at Rome, Ga., 0 to 30 feet; at Greenport, Ala., 0 to 15 feet; at Wetumpka, Ala., 0 to 50 feet.

The improvement of these rivers is provided for under the two following projects (for reference to report upon proposed modifications of projects for improving the Coosa River, see Annual Report of the Chief of Engineers for 1905, p. 326):

(*a*) *Coosa River between Rome, Ga., and East Tennessee, Virginia and Georgia Railroad bridge.*—The original project for the improvement of the Coosa River contemplated the opening of a continuous water route of transportation from the Mississippi River to the Atlantic Ocean by way of the Ohio, Tennessee, Coosa, Etowah, Ocmulgee, and Altamaha rivers, with canals from the Tennessee to the Coosa and from the Etowah to the Ocmulgee. This was designated as the "southern route."

Various examinations and estimates for the improvement of parts of this section of river have been made from time to time up to the adoption of the existing project, September 19, 1890. This project, as modified by act of Congress of July 13, 1892, formed a part of a plan submitted in 1875 for a proposed waterway from the Mississippi to the Atlantic via the Tennessee River, and provides for a crib and timber lock 200 by 32 feet and a 3-foot lift, with excavation for a 4-foot channel between Rome, Ga., and Wills Creek in Alabama, at a total estimated cost of $180,000; for three locks between Greenport and Lock 4 (Whisenant and Ten Island shoals), 210 feet long, 40 feet wide, and an extreme low-water depth of 4 feet on miter sills, together with a 3-foot channel between Locks 1 and 3, at a total estimated cost, including accessory dams and dikes, of $155,616.23; for five locks and dams from and including Lock 4 to the East Tennessee, Virginia and Georgia Railroad bridge, the locks to have an available length of 280 feet, width of 52 feet, and an extreme low-water depth of 6 feet over the miter sills, together with a connecting channel 100 feet wide and 4 feet deep at extreme low water, at a total estimated cost of $1,160,491, or at a total cost for the entire improvement of $1,496,107.23. About 21 per cent of the project has been completed.

To June, 30, 1908, there has been expended on this section of the Coosa $1,074,583.74, of which $550,983.74 has been expended upon the existing project and $523,700 prior to its adoption. The work accomplished is as follows, of which expenditures about 10 per cent has been for maintenance:

Locks 1, 2, and 3, Coosa River, commenced prior to 1890, have been completed. They are situated, respectively, 0.68 mile, 3.86 miles, and 5.24 miles below Greenport, Ala., and have available lengths of 175 feet and widths of 40 feet.

Lock 4 (25.89 miles below Greenport), commenced since the adoption of larger dimensions above mentioned, has, together with its appurtenances, been under construction, with desultory appropriations, since 1886, but still incomplete.

Channel improvement has been extended as far down as Lock 4, and navigation is now possible to this point, except at extreme low water, when interruptions occur a short distance above Lock 4.

During the past fiscal year work was confined to the improvement and maintenance of the channel between Rome, Ga., and Lock 4, Alabama, and to care of the large amount of plant on hand. Provision should be made for further improvement and maintenance of this channel.

There was received from the Seaboard Air Line Railway for dredging, $64.92.

On June 30, 1908, the maximum draft that could be carried at ordinary low water between Rome, Ga., and Lock 4 was 3 feet, except at Horseleg shoals, 1½ miles below Rome, over which but 2 feet can be carried until a lock is constructed at this point. Survey and estimate for this lock is now being made.

It is proposed to apply the additional appropriation recommended toward further improvement and maintenance of the channel between Rome, Ga., and Lock No. 4, Alabama.

The improvement has resulted in a reduction in railroad rates between points on the river and either Rome or Gadsden of not less

than 50 per cent, water rates controlling all shipments to and from the country contiguous to the river.

The commerce of this portion of the Coosa consists principally of cotton, cotton seed, fertilizer, timber, lumber, staves, grain, and miscellaneous articles, amounting for the year 1907 to 8,511 tons valued at $854,000.

(*b*) *Coosa River between Wetumpka and East Tennessee, Virginia and Georgia Railroad bridge.*—On account of the numerous rapids this part of the river has never been navigable.

The original project for the improvement of this section of the river, adopted September 19, 1890, as the result of a survey made in 1889 and modified by Congress July 13, 1892, contemplates slackwater navigation and provides for the construction of 23 locks and dams of varying lifts, of an available length of 280 feet and width of 52 feet, with 6 feet over the miter sills, no lift of lock to exceed 15 feet. In addition, the channel is to be cleared of various rock reefs and points so as to give a least depth of 4 feet, all at an estimated cost of $5,106,422. About 4 per cent of the project has been completed.

There has been expended on this project to June 30, 1908, $400,798.57, of which about 2½ per cent has been for maintenance, which has resulted in the construction of the lowest lock of the series, known as "No. 31," excepting the dam and gates, the excavation of the channel between this lock and the one next above, and the preparation of data and plans for additional locks and dams, but these data are still incomplete. As yet no benefit has been derived from this improvement, and its value is entirely dependent on the completion of the entire system.

There was received from sale of old property, $27.50.

Provision should be made for the care of the property belonging to the improvement.

CONSOLIDATED.

July 1, 1907, balance unexpended		[a] $57,059.09
Received from sale of old property		27.50
Received from Seaboard Air Line for dredging		64.92
		57,151.51
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$21,620.83	
For maintenance of improvement	5,000.00	
		26,620.83
July 1, 1908, balance unexpended		30,530.68
July 1, 1908, outstanding liabilities		3,107.39
July 1, 1908, balance available		27,423.29
Amount (estimated) required for completion of existing project		6,059,913.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		100,000.00

(See Appendix Q 12.)

[a] Erroneously given as $57,054.09 in report for 1907.

13. Operating and care of canals and other works of navigation on Coosa River, Georgia and Alabama.—Locks 1, 2, and 3 were opened to navigation on June 30, 1890, and have been operated continuously ever since, except during such periods as it was necessary to close them for repairs and for a period of ten days in February, 1895, when the canal between Locks 2 and 3 was frozen over.

The amount expended to the end of the fiscal year ending June 30, 1908, was $179,796.59.

The expenses of operating and care of Locks 1, 2, and 3, and Dam 4 during the fiscal year have been paid from the permanent indefinite appropriation provided for by section 4 of the act of July 5, 1884. These expenses amounted to $16,037.14, exclusive of liabilities outstanding on June 30, 1908, of $442.90.

(See Appendix Q 13.)

14. Removing sunken vessels or craft obstructing or endangering navigation.—The tug *Florence Witherbee*, sunk in Pensacola Harbor, Florida, was removed under contract with Mr. G. H. Langley.

The sunken lighter *Georgia*, at the mouth of Apalachicola River, Florida, was removed under contract with Mr. Alex. C. Kittel and Marion C. Lang.

The total expenditures during the year on removal of wrecks amounted to $2,265.45.

(See Appendix Q 14.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of St. Josephs Bay, Florida.—Report dated November 14, 1907, is printed in House Document No. 464, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. Preliminary examination of Pensacola Bay, Florida, with a view to getting 24 feet of water to the quarantine station.—Report dated November 14, 1907, is printed in House Document No. 665, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

3. Preliminary examination of Wakulla River from the town of St. Marks to the Gulf of Mexico, and St. Marks River, Florida.—Report dated December 21, 1907, is printed in House Document No. 851, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

4. Preliminary examination of Choctawhatchee River, Florida, with a view to providing a depth of 3 feet up to Newton, Ala.—Report dated December 23, 1907, is printed in House Document No. 876, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government in the manner proposed.

The local officer was also charged with the duty of making preliminary examinations and surveys provided for in the river and harbor

act of March 2, 1907, as follows, and reports thereon will be duly submitted when received:

1. St. Andrews Bay, Florida.

2. Alabama and Coosa rivers between Montgomery and Wetumpka, Ala.

3. Coosa River, Alabama, with a view to locating and constructing Dam No. 5.

4. Coosa River, Georgia, at Horseleg shoals.

IMPROVEMENT OF RIVERS AND HARBORS IN THE MOBILE, ALABAMA, DISTRICT.

This district was in the charge of Maj. Henry Jervey, Corps of Engineers, having under his immediate orders First Lieut. William G. Caples, Corps of Engineers, since October 21, 1907. Division engineer, Col. E. H. Ruffner, Corps of Engineers.

1. Mobile Harbor, Alabama.—This channel originally had minimum depths of 5½ feet through Choctaw Pass and 8 feet through Dog River bar, the available draft to Mobile, via Spanish River, being limited to the latter depth.

The improvement of the channel of Mobile Harbor has been progressive. Between 1826, the date of the first appropriation for this work, and 1857 a channel 10 feet deep was dredged through the shoals in Mobile Bay up to the city of Mobile. Between 1870 and 1876 this depth was increased to 13 feet, the channel being dredged to a width of 300 feet through Choctaw Pass and 200 feet through Dog River bar.

In 1880 a project for a channel 17 feet deep and 200 feet wide was adopted, and appropriations between 1878 and 1886 were applied to the formation of a channel of these dimensions.

In the river and harbor act of August 11, 1888, a project for securing a channel 23 feet deep was adopted, this project being modified by the river and harbor act of September 19, 1890, so as to provide for the formation of a channel 23 feet deep and with a top width of 280 feet from the Gulf of Mexico to the mouth of Chickasaw Creek, above the city of Mobile. Work upon this channel was completed in 1896, subsequent appropriations, up to and including that made by the sundry civil act of July 1, 1898, having been applied to its maintenance.

The total amount expended on these projects was $3,648,630.60, of which about $115,000 is estimated to have been applied to maintenance.

The existing project for the improvement of Mobile Harbor provides for the formation of a channel 23 feet deep and 100 feet wide at bottom, with appropriate slopes, from the entrance of the bay to the mouth of Chickasaw Creek, at an estimated cost of $1,640,000, and the removal of sunken obstructions from Mobile Harbor at such times as the latter work may be authorized. This project was adopted by the river and harbor act approved March 3, 1899, and was modified by the acts of June 13, 1902, and March 3, 1905.

The work of forming a 23-foot channel in Mobile River and Bay under this project was commenced in 1899, and under two continuing contracts, during the progress of which 12,402,956 cubic yards of material, scow measurement, was removed up to November 11, 1903, an uninterrupted channel of the projected depth and from 55 to 150 feet width was formed within the limits of the project.

After the storm of September 27, 1906, the channel shoaled in places to as little as 17 feet. Under a contract the worst of the shoaling was remedied at a cost of approximately $100,000, 1,109,410 cubic yards of material being removed.

The work of removing sunken trees, logs, timbers, and other dangerous obstructions from the channel of Mobile Harbor has been prosecuted when necessary with funds allotted for that purpose.

The existing project was modified by the river and harbor act of March 2, 1907, so as to include the completion of the work proposed by the existing project at an estimated cost of $560,000, and the prosecution of operations to provide increased depth progressively as may be possible with appropriations of $100,000 annually for a period of five years. The act authorized continuing contracts for prosecuting the work in the sum of $360,000, of which $200,000 is yet to be appropriated, and the application of $10,000 to the removal of sunken obstructions from the harbor. The construction of a dredge was also authorized. The administrative act approved May 28, 1908, contains the following provision:

SEC. 7. That the whole or any part of the amount heretofore authorized to be appropriated for the construction of a dredge for Mobile Harbor, Alabama, with the exception of five thousand dollars for the preparation of plans for said dredge, may be used for dredging said harbor, and the Secretary of War, in his discretion, may enter into a contract or contracts for the performance of the work.

The modification of project is printed in House Document No. 647, Fifty-ninth Congress, first session.

To June 30, 1908, there was expended on the existing project as modified $1,499,448.74, of which $373,086.28 was applied to work of maintenance.

Under date of July 10, 1907, a contract was entered into for dredging under the modified project.

The amount of money to be applied to this contract is about $320,000, not including incidental expenses, and work thereunder is almost completed. As a result, depths ranging from 23½ to 25 feet have been obtained, with a bottom width of about 100 feet, from a point 510 feet above Beacon 22 to the lower end of the dredged channel and for 1,300 feet in Mobile River near Chickasaw Creek. When this contract is completed early in the coming fiscal year, these depths will prevail throughout the channel, except where shoaling has occurred in the lower end since dredging was done there.

The designs of a dredge and attendant plant are about 66 per cent completed.

A test of the dredge *Barnard* was made in this channel with unsatisfactory results, due largely to rough weather.

During the year 1,833 sunken obstructions were removed from the navigable channel, adding much to the safety of traffic.

Under the existing project any depth, of 23 feet or greater at mean low water, is authorized. The amount estimated for completion of the project in the accompanying money statement is the amount estimated as necessary to obtain a depth of 23 feet only at mean low water with appropriate side slopes, this being the only depth for which estimates have heretofore been made. The 23-foot depth and bottom width of 100 feet have been dredged, but the "appropriate side slopes" have not yet been obtained. A dredge owned and *operated* by the United States is essential to the proper conduct of

work under this project. For economy, it is considered indispensable.

On June 30, 1908, the maximum low-water draft that could be carried over the shoalest part of the dredged channel was between 23 and 24 feet at mean low water. The average range of tide is 1½ feet.

With available funds and future appropriations it is proposed to continue dredging under the existing project; to complete the designs for a dredge and attendant plant and to build same, and to continue the work of removing sunken obstructions from the improved channel.

In Appendix R 1 of this report the district engineer officer draws attention to the desirability of providing a cut-off in the dredged channel at the "Elbow" below the mouth of the Mobile River, similar to the one proposed in the survey report printed in House Document No. 647, Fifty-ninth Congress, first session. It is recommended that provision for a suitable cut-off be made in connection with any legislation for further improvement at this locality, the exact location of the new channel to be determined when the additional dredging shall have been authorized.

Mobile River is navigable for vessels of about 14 feet draft up as far as its head, 45 miles above Mobile.

Detailed information with reference to the work accomplished under the existing project is contained in the Annual Reports of the Chief of Engineers for 1901, page 1810, and 1904, page 1803. A reference to the report of the survey upon which the project is based is printed in the Annual Report of the Chief of Engineers for 1904, page 324.

The combined commerce, foreign and domestic, using Mobile Harbor during 1907 aggregated 3,045,123 tons, valued at $60,372,245. Cotton, lumber, timber, breadstuffs, and hog products are the principal articles of export, and bananas and sisal grass the most important of imports.

The effect of the project has been to give Mobile an average reduction of about 20 per cent on rail freight rates from Atlantic seaport cities and to afford direct water freight rates from Mobile to foreign ports.

GENERAL IMPROVEMENT.

July 1, 1907, balance unexpended		$190,630.36
Amount appropriated by sundry civil act approved May 27, 1908		160,000.00
		350,630.36
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$88,000.00	
For maintenance of improvement	102,391.82	
		190,391.82
July 1, 1908, balance unexpended		160,238.54
July 1, 1908, outstanding liabilities		138,600.00
July 1, 1908, balance available		21,638.54
July 1, 1908, amount covered by uncompleted contracts		2,000.00
Amount (estimated) required for completion of existing project		272,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

[a] *See consolidated* money statement on page 396.

REMOVING OBSTRUCTIONS.

July 1, 1907, balance unexpended		$9,886.30
June 30, 1908, amount expended during fiscal year for maintenance of improvement		8,472.71
July 1, 1908, balance unexpended		1,413.59
July 1, 1908, outstanding liabilities		400.00
July 1, 1908, balance available		1,013.59
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		([a])

CONSOLIDATED.

July 1, 1907, balance unexpended		$200,516.66
Amount appropriated by sundry civil act approved May 27, 1908		160,000.00
		360,516.66
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$88,000.00	
For maintenance of improvement	110,864.53	
		198,864.53
July 1, 1908, balance unexpended		161,652.13
July 1, 1908, outstanding liabilities		139,000.00
July 1, 1908, balance available		22,652.13
July 1, 1908, amount covered by uncompleted contracts		2,000.00
Amount (estimated) required for completion of existing project		272,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[b]492,000.00

(See Appendix R 1.)

2. Mobile bar, Alabama.—Mobile bar is located in the Gulf of Mexico off the entrance to Mobile Bay. This bar had a depth of 23 feet at low water over ample width before any work of improvement was commenced upon it. This depth accommodated all the traffic of the Mobile Bay ship channel, but was not sufficient to permit of the utilization of the deep anchorage in lower Mobile Bay beyond the southern limit of the dredged cut leading to the city of Mobile.

The original and existing project for this improvement was adopted in the river and harbor act of June 13, 1902, and provides for the formation of a channel 30 feet deep at low water and 300 feet wide across Mobile bar, at an estimated cost of $91,250. This work of improvement formed a part of the Mobile Harbor project until March 3, 1905, when, by the river and harbor act of that date, it was made a separate project, and the limit of cost was increased to $100,000.

Up to June 30, 1908, the sum of $124,918.37 had been expended on this improvement, of which about $41,918.37 was applied to maintenance.

[a] See consolidated money statement on this page.

[b] Of this amount $200,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907.

During the past fiscal year the U. S. dredge *Charleston* has been engaged most of her time in removing shoals and increasing the depth and width. The depth now ranges from 27½ to 34 feet throughout the channel, except a few ridges near the edges where the depth is about 24 feet. The project is about 83 per cent completed.

The maximum draft that can be carried through the channel at mean low water is now about 27½ feet, and the average range of tide is 1.1 feet.

Available funds and future appropriations will be applied to maintaining the channel and completing it according to the project, and to making necessary repairs to the dredge *Charleston*.

For commercial statistics and effect of improvement on freight rates see report on Mobile Harbor.

A reference to the report of the survey on which the existing project is based can be found in the Annual Report of the Chief of Engineers for 1904, page 324.

July 1, 1907, balance unexpended		$52,919.35
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$10,919.35	
For maintenance of improvement	16,918.37	
		27,837.72
July 1, 1908, balance unexpended		25,081.63
July 1, 1908, outstanding liabilities		7,000.00
July 1, 1908, balance available		18,081.63
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix R 2.)

3. Black Warrior, Warrior, and Tombigbee rivers, Alabama.—(*a*) *Black Warrior River.*—This name refers to that portion of the Warrior River above Tuscaloosa. Originally this part of the river was practically closed to navigation on account of shoals at and above Tuscaloosa.

The original project for the improvement was adopted in 1887, the object being to obtain a channel for barges of 6 feet draft at low water all the year round between Tuscaloosa and Daniels Creek, 14½ miles above, by means of five locks and dams, at an estimated cost of $741,670.

Locks 10, 11, and 12 (formerly known as 1, 2, and 3) were built by hired labor and have been completed and opened for traffic since November, 1895.

The river and harbor act of March 3, 1899, provided for the construction of Lock 4 (now Lock 13), at a cost not to exceed $190,500. As it was subsequently found that the lock could not be completed for the amount appropriated, the river and harbor act approved June 13, 1902, authorized the transfer of $14,000 from the unexpended balance of the Warrior River appropriations for the completion of this lock. The same act extended the upper limit of the improvement to the junction of the Mulberry and Locust forks of the river, 46½ miles above Tuscaloosa, and provided for making a survey for the location of Locks 5 and 6 (now 14 and 15) next above

Lock 4. Report of this survey is printed in the Annual Report of the Chief of Engineers for 1904, page 1840.

The river and harbor act of March 2, 1907, provides for the construction of Locks and Dams 14, 15, 16, and 17, at an estimated cost of $1,409,000, to be provided under continuing-contract authorization, leaving Locks and Dams 18, 19, and 20, previously estimated to cost $1,047,000, to be provided for. These estimates were exclusive of cost of surveys and sites, $30,000, and additional land required at Lock No. 10, $5,000.

During the past year it was decided to use two locks of 21 feet lift on Squaw shoals instead of three locks of 14 feet lift, and surveys were made to determine the most suitable locations for the remaining locks and the cost of completing the whole project from Mobile to the junction of the Mulberry and Locust Forks of the river.

Work so far completed has been the construction of Locks 10, 11, 12, and 13. Six feet of navigation can be carried 12 miles above Tuscaloosa to site of Lock 14. Contract has been let for the construction of Locks and Dams 14 and 15 and locktenders' houses. The contractor has built locktenders' houses and his own camps, installed a large amount of plant, delivered considerable material, and at Lock 14 has about 75 per cent of lock cofferdam constructed and most of excavation for foundations of lock walls removed. A telephone line has been built to connect these locks with Government line at Lock No. 13. A well has been drilled for furnishing drinking water at Lock No. 14, and drilling one at Lock No. 15 is now in progress. Plans and specifications for Lock No. 16 have been prepared and forwarded for approval, and negotiations for purchase of sites for Locks 16 and 17 are now in progress. Plans and specifications for Lock 17 are nearly completed.

The total amount expended on this improvement to June 30, 1908, including the surveys mentioned above, was $867,991.42; none of which was applied to maintenance.

The improvement of the Black Warrior River between Tuscaloosa and Daniels Creek is based upon the report of a Board of Engineers, dated April 2, 1887, and published in the Annual Report of the Chief of Engineers for 1887, page 1302.

For commercial statistics, see report on operating and care of locks and dams on Black Warrior River, Alabama.

(*b*) *Warrior River.*—This name refers to that portion of the Warrior River below Tuscaloosa. Originally logs, snags, and overhanging trees rendered navigation impossible at low water and dangerous at boating stages. The minimum depth of channel was about 1 foot and the minimum width about 60 feet.

The original project for the improvement, adopted by the river and harbor act approved March 3, 1875, contemplated deepening the channel by jetty construction and the removal of snags and overhanging trees. The amount expended on this project from 1880 until the adoption of the present project was $319,372. Prior to 1880 appropriations aggregating $88,000 were expended on the Warrior and Tombigbee rivers jointly, and an account of this work may be found in the Annual Report of the Chief of Engineers for 1897, page 1679.

The present project, adopted by the river and harbor act of March 3, 1899, is for the construction of six locks and dams (Nos. 4–9, inclusive, of the Black Warrior, Warrior, and Tombigbee system), with a *total lift of 60* feet, and is to afford a channel for barges of 6 feet

draft at low water all the year round. The estimated cost of this work was $1,928,466, but repeated rises in the river prevented their completion during the past year and this amount will be exceeded. The amount needed for completion of these locks, as well as the fishways required at Dams Nos. 7, 8, and 9, is included in the amount needed to complete the whole project mentioned under Tombigbee River. This work was commenced under continuing contract, but the completion of three of the locks by hired labor has been authorized. These three locks were completed at a cost of $640,500, and are now being operated and cared for by the Government as Locks Nos. 7, 8, and 9, Black Warrior River. This work has resulted in opening up the river from Tuscaloosa to Lock 7, a distance of 79 miles, for navigation all the year round, though some dredging will be necessary to obtain a channel depth of 6 feet at the upper end of each pool. Towboats and barges of 4 feet draft have been operated on this section of the river during each low-water season since these locks were completed.

The river and harbor act approved June 13, 1902, provided for the construction of Locks and Dams Nos. 1, 2, and 3 (new Nos. 4, 5, and 6), on this river, at a cost not to exceed $874,000; also that $10,000 of this amount might be applied to the work of maintenance of the improvement between Tuscaloosa and Demopolis.

Work on these locks was commenced under contract in May, 1903, and continued until December 31, 1904, when contractors abandoned the work. During February, 1905, the completion of these locks by hired labor was authorized. Since that time all three locks and abutments have been completed and the dams about 90 per cent completed. Gates have been installed at two of the locks and they have been open for traffic during the past winter. Gates at the third lock are now being erected and should be opened for traffic in a few days. Work is now in progress on the dams, which should all be completed in the next two months.

Changes in foundations, due to physical conditions at the sites, and increased cost of engineering expenses and contingencies, due to delays and final abandonment of work by contractors, and numerous rises in the river during the last three working seasons, will increase the cost of these locks above the amount originally authorized. The river and harbor act approved March 3, 1905, provided for the completion of these locks and the construction of Locks and Dams Nos. 1 and 2 in the Tombigbee River at a cost not to exceed $881,466; also that not more than $40,000 of this amount could be expended in the construction of a dredge and not more than $30,000 for the construction of lock houses.

The river and harbor act of March 2, 1907, provides for the completion of the three Warrior River locks, on which work is now in progress, and it is believed that they will be finished early this season.

The total amount expended on improvement of Warrior River under the existing project to June 30, 1908, was $2,006,539.75, of which $13,691.24 was applied to maintenance.

For commercial statistics, see report on "Operating and care of locks and dams on Black Warrior River." In addition to the commerce passing through these locks, about 17,000 tons of logs was shipped from points below Lock 7.

The report of the survey upon which the present project is based is printed in the Annual *Report* of the Chief of Engineers for 1890,

page 1719. For revised estimate by the local engineer officer of the cost of building Locks and Dams Nos. 1, 2, and 3, see Annual Report of the Chief of Engineers for 1904, page 1845.

(*c*) *Tombigbee River from the mouth to Demopolis* (*construction of locks and dams*).—The original condition of the navigable channel of this section of the river was such as to permit of steamboat navigation during high stages of water only, lasting about six or eight months of the year. The minimum width of the channel was about 100 feet and the minimum depth about 2 feet.

For project, amount expended, etc., see report on maintenance of channel, Tombigbee River from the mouth to Demopolis.

The amount expended on work of lock and dam construction under the existing project to June 30, 1908, was $545,742.49; for construction of dredge, $40,030, and for construction of lock houses, $10,315.16.

The river and harbor act of June 13, 1902, directed that a survey be made to determine the cost of completing Lock 1 and the location and cost of Locks 2 and 3, and this survey was made during 1902 and 1903. Report thereon is printed in the Annual Report of the Chief of Engineers for 1904, page 1842. During the fiscal year 1905 a part of the survey was gone over for the purpose of selecting more economical locations for Locks 2 and 3.

The river and harbor act approved March 3, 1905, made an appropriation of $100,000, and provided for the further appropriation of $781,466, to be applied to the completion of Locks and Dams Nos. 1, 2, and 3, Warrior and Tombigbee rivers, Alabama, and of Lock No. 1, Tombigbee River, and the construction of Lock No. 2, Tombigbee River. It was also provided that of these sums $40,000 might be expended for the construction of a dredge and $30,000 for the construction of lock houses necessary for the operation of locks and dams in the Black Warrior, Warrior, and Tombigbee rivers. The sundry civil act approved June 30, 1906, appropriated $543,466 of the amount authorized by the river and harbor act of March 3, 1905, and the sundry civil act approved March 4, 1907, carried the balance of $238,000. Provision was made in the river and harbor act of March 2, 1907, for construction of Lock and Dam No. 3 under continuing contract at a cost of $483,000.

At the beginning of the fiscal year Lock 1, at McGrew shoals, was about 75 per cent completed. During the year the erection of gates was finished, the abutment and 260 linear feet of the dam built, and 40 linear feet more, about 50 per cent, built. During the construction of the dam, when the stage of water was such that boats could not pass through the gap between the lock and the completed part of the dam, boats were passed through the locks. This lock and dam is about 85 per cent done.

Contract was entered into for building Locks and Dams 2 and 3 under date of December 4, 1907. Work has been commenced at these locks, but continuous high water has interfered with operations.

One lock-tender's house was completed at Lock 3, and the building of the dredge was finished. The installation of machinery and purchase of pipe line are not yet finished, but will be paid for from other appropriations. The telephone line between Locks 1 and 2 was completed and then extended to Lock 3.

For commerce in the calendar year 1907, see report on Tombigbee River, mouth to Demopolis.

The recent appropriations for slack-watering the Black Warrior, Warrior, and Tombigbee rivers have been made for one system of locks and dams, and not for those on the different rivers, so that this is now considered one project, the estimated cost of which is $7,195,643.89, exclusive of maintenance.

On this project there was expended up to the close of the past fiscal year $3,470,618.82, including the cost of dredge and lock houses and $13,691.24 applied to maintenance work. Estimates based on prices bid on last four locks contracted for in this district show that in addition to amounts already appropriated or authorized, $1,600,000 will be required to complete work under the general project, or an increase of $511,000 over estimates heretofore made, divided as follows:

For completing all locks and dams	$1,460,000
For dredging between locks necessary to obtain 6-foot depth	100,000
For removing snags and overhanging trees (original work)	30,000
For building fishways in dams at Locks 7, 8, 9, 10, 11, 12, and 13	10,000
Total	1,600,000
Amount authorized but not yet appropriated	1,312,000
Total amount required to complete the project up to the junction of the Mulberry and Locust forks of Black Warrior River, the upper limit	2,912,000

It is therefore proposed to apply funds available for locks and dams and the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to the completion of Locks and Dams No. 1, Tombigbee River, at McGrew shoals, and Nos. 1, 2, and 3, Warrior River, the construction of Locks and Dams Nos. 2 and 3, Tombigbee River, and 14, 15, and 16, Black Warrior River; and commencement of work on Lock 17, same river.

The project for all-year-round 6-foot navigation from the Mulberry and Locust forks of the Black Warrior River to Mobile, Ala., has not yet progressed sufficiently to have much, if any, effect on freight rates; but when completed it is expected to cause a great reduction in such rates from the mining section of Alabama to the Gulf of Mexico.

LOCKS AND DAMS.

July 1, 1907, balance unexpected	$778,176.31
Amount appropriated by sundry civil act approved May 27, 1908	530,000.00
June 30, 1908, sales of Government property	13.60
June 30, 1908, refundment of overpayment	15.01
	1,308,204.92
June 30, 1908, amount expended during fiscal year for works of improvement	501,173.45
July 1, 1908, balance unexpended	807,031.47
July 1, 1908, outstanding liabilities	43,500.00
July 1, 1908, balance available	763,531.47
July 1, 1908, amount covered by uncompleted contracts	1,412,660.00
Amount (estimated) required for completion of existing project	2,912,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	1,000,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

DREDGE.

July 1, 1907, balance unexpended	$3,445.70
June 30, 1908, refundment of an overpayment	30.00
June 30, 1908, amount expended during fiscal year for works of improvement	3,475.70

LOCK HOUSES.

July 1, 1907, balance unexpended	$22,267.49
June 30, 1908, amount expended during fiscal year for works of improvement	2,582.65
July 1, 1908, balance unexpended	19,684.84

CONSOLIDATED.

July 1, 1907, balance unexpended	$803,889.50
Amount appropriated by sundry civil act approved May 27, 1908	530,000.00
June 30, 1908, sales of Government property	13.60
June 30, 1908, refundment of overpayments	45.01
	1,333,948.11
June 30, 1908, amount expended during fiscal year for works of improvement	507,231.80
July 1, 1908, balance unexpended	826,716.31
July 1, 1908, outstanding liabilities	43,500.00
July 1, 1908, balance available	783,216.31
July 1, 1908, amount covered by uncompleted contracts	1,412,600.00
Amount (estimated) required for completion of existing project	2,912,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	1,000,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(*d*) *Tombigbee River from the mouth to Demopolis* (*maintenance of channel*).—The original condition of the channel of this portion of the river was such as to permit of steamboat navigation during high-water stages only, lasting about six or eight months of the year. The minimum width of the channel was about 100 feet and the minimum depth 2 feet.

The original project for the improvement of this stream, as adopted in 1871, contemplated the removal of snags and other obstructions in the channel of the river and the widening and deepening of the existing channel through various shoals, at an estimated cost of $21,500. The project adopted in 1879 was to afford a channel of navigable width and 4 feet deep at ordinary low water from the mouth to Demopolis, a distance of 185 miles, by the removal of snags, logs, and overhanging trees, and the improvement of the worst bars by dredging.

The amount expended on the improvement of this section of Tombigbee River under previous projects can not be given, as joint appropriations for the Warrior and Tombigbee rivers were made from 1875 to 1879, while between 1880 and 1888 the lower division of the river, for which appropriations were made, extended from Vienna to the mouth.

The earlier projects for the improvement of this section of Tombigbee River were superseded by the project adopted in the river and harbor act of September 19, 1890. The project adopted at that time provided for securing a channel 6 feet deep at low water between the mouth and Demopolis by the construction of locks and dams and bank revetments, and by the removal of logs, snags, and other obstructions. The cost of this project was originally estimated at $508,808.98, but in 1897 after $330,000 had been appropriated for the work, the estimate was increased, the additional cost of completion being then placed at $600,000.

By the river and harbor act of June 13, 1902, the formation of a 6-foot channel below Demopolis by constructing locks and dams was made a part of the project for securing 6-foot navigation in the Black Warrior, Warrior, and Tombigbee rivers, Alabama. Information in regard to work accomplished on the Tombigbee River under this project and the expenditures made in connection therewith will be found in the section of this report immediately preceding.

Under previous projects this section of the Tombigbee River has been repeatedly cleared of snags, dikes have been constructed, dredging has been done at the worst bars, and the channel made navigable for steamboats at low stages of the river. The existing project for maintenance of the improvement of the Tombigbee River from the mouth to Demopolis was adopted by the river and harbor act of June 13, 1902, and contemplates the maintenance of the existing channel by the removal of logs, snags, and other obstructions from the stream, and by the repair of dikes.

The amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1908, was $28,915.87, all of which was applied to maintenance. All work under this project has been performed with the United States plant and hired labor, and the channel of the stream has been maintained in a navigable condition. Part payment has been made from this appropriation for completing a United States dredge to be used on this and other rivers in the district.

During the past fiscal year a few obstructions were removed by the U. S. snag boat *Black Warrior*. The district officer reports this boat about worn out and points out the necessity of replacing it with another snag boat, the new one now building for this river and the Pascagoula, Leaf, and Chickasahay rivers not being sufficient for all the work. The new snag boat referred to is now being built under contract with Ed. J. Howard, at Jeffersonville, Ind.

It is proposed to apply available funds and future appropriations to maintaining the improvement by snagging, dredging, and construction of jetties, to the installation of machinery and completion of dredge, and to part payment for the construction of self-propelling snag boat under contract.

The Tombigbee River is navigable for steamboats as far up as Columbus, Miss., a distance of 341 miles above its mouth, and for rafts as far up as Walkers Bridge, Miss., a farther distance of 169 miles. This stream is nontidal except in its lower reaches. Floods at Demopolis rise at times to a stage of 60 feet above low water.

Detailed accounts of this improvement are contained in the Annual Reports of the Chief of Engineers for 1896, page 1437; 1897, page 1685, and 1900, page 2202.

Commerce on this section of the river in the calendar year 1907 aggregated 429,931 tons, valued at $8,600,479.

This project results in affording cheap water rates between Mobile and points along the lower Tombigbee River.

July 1, 1907, balance unexpended	$26,568.30
June 30, 1908, amount expended during fiscal year for maintenance of improvement	4,635.17
July 1, 1908, balance unexpended	21,933.13
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	26,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*e*) *Tombigbee River from Demopolis, Ala., to Columbus, Miss.*—The original condition of this section of the river was such as to admit of navigation only during high-water stages. The channel was obstructed by shoals, logs, and overhanging trees, the minimum depth of water being 1 foot and the minimum width of channel 70 feet. The improvement of the Tombigbee River between Demopolis and Columbus was commenced under the project of 1871, which contemplated the improvement of this stream by the removal of snags and other obstructions in the river and the widening and deepening of existing channels through various bars. In 1879 this project was modified so as to provide for the formation of a channel of navigable width and 3 feet deep at low water from Demopolis to Columbus, this section forming a part of two different improvements.

The earlier appropriations being made for the Warrior and Tombigbee rivers jointly, the exact amount expended on the original project for this improvement can not be stated.

The present project for improvement of this section of Tombigbee River, adopted in 1890, provides for securing a channel 6 feet deep at low water from Demopolis to Columbus, a distance of 156 miles, by snagging, tree cutting, bank revetment, bar improvement, and the construction of locks and dams, at a cost originally estimated at $779,400. In 1897 the construction of locks and dams was estimated to cost $2,000,000. This project was adopted by the river and harbor act of September 19, 1890, but no provision has yet been made by Congress for commencing the work of lock and dam construction. The fall of the river from Columbus to Demopolis is about 108 feet.

The total amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1908, was $172,312.06, of which about $71,855.17 was applied to maintenance. These expenditures have resulted in the formation of a clear channel within the limits of the project available for light-draft boats on a 2-foot rise above low water and in the partial maintenance of this improvement. Work has been prosecuted by means of United States plant and hired labor.

During the past fiscal year about 44 miles of this section of river were worked over with the snag boat *Vienna* up to December 26, 1907, at which time operations were interrupted by high water and the boat was laid up until next low-water season; 3,409 obstructions were removed.

It is proposed to apply available funds and future appropriations to the work of maintaining the improvement by the removal of snags, trees, and other obstructions brought into the channel by freshets. The maximum height of these freshets at Columbus is 40 feet.

The commerce on this section of the river for the calendar year 1907 amounted to about 6,655 tons, valued at $311,537.

This project results in affording water rates from Mobile to points on the Tombigbee River above Demopolis for several months each year.

July 1, 1907, balance unexpended	$14,063.43
June 30, 1908, amount expended during fiscal year for maintenance of improvement	4,375.49
July 1, 1908, balance unexpended	9,687.94
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	22,000.00

(*f*) *Tombigbee River from Columbus to Walkers Bridge, Miss.*—Prior to 1902 this improvement was divided into two sections, one from Columbus to Fulton, 144 miles, and the other from Fulton to Walkers Bridge, 25 miles, for which appropriations were made separately.

The original condition of the river was such that navigation was impossible except at high water, and difficult even at that stage, owing to the logs, snags, and overhanging trees which obstructed the channel. The minimum depth in the channel was about 1 foot, and the minimum width was 50 feet.

The project for the improvement of the river above Columbus was adopted in 1873, and provided for obtaining a good high-water channel by the removal of obstructions, at an estimated cost of $35,000. This project was completed in 1882, at a cost of $27,293.65, since which time operations have been directed toward maintaining the improvement. The first specific appropriation for the portion of the river between Fulton and Columbus was made in 1892, this money, together with subsequent appropriations, being applied to the maintenance of a high-water channel.

The project for improvement of the river from Fulton to Walkers Bridge was adopted in 1888, and provides for securing a high-water channel by the removal of logs, snags, and overhanging trees, at an estimated cost of $11,000, and for the maintenance of the same at an annual cost of $1,500. This project was adopted by the river and harbor act of August 11, 1888, and was completed in 1891, at a cost of $6,517.19.

The total amount expended on these projects up to the close of the fiscal year ending June 30, 1908, was $76,595.91, of which amount $42,785.07 had been applied to maintenance. United States plant and hired labor have been employed on this work.

During the past fiscal year about 60 miles of this section of river were worked over, resulting in the removal of 28,335 obstructions and marked benefit to navigation.

As a result of the work done on this section of Tombigbee River it has been possible to bring large rafts of logs and timber down on a rise of a few feet above low water, but the freshets here range from 20 to 40 feet during the high-water season and many obstructions are brought into the stream by these floods, rendering it necessary to remove such obstructions each season in order to keep the channel open. This part of the river is nontidal.

It is proposed to apply available funds and future appropriations to the work of maintaining a high-water channel within the limits of the improvement.

A reference to reports on surveys upon which a portion of this project is based is printed in the Annual Report of the Chief of Engineers for 1905, page 340.

The commerce on this section of the river during the calendar year ending December 31, 1907, amounted to 35,523 tons of logs, valued at $160,000.

Funds for work on this part of the river are allotted from the appropriation for Tombigbee River, Demopolis to Columbus.

This project has no effect on freight rates.

July 1, 1907, balance unexpended	$2,291.95
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,220.81
July 1, 1908, balance unexpended	71.14
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	5,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix R 3.)

4. *Operating and care of locks and dams on Warrior and Black Warrior rivers, Alabama.*—(*a*) *Lock 7.*—This lock is about 79 miles by river below Tuscaloosa. Contract work was completed and the lock turned over to the United States November 7, 1903. At that time its operation and care became a charge under the general law of July 5, 1884.

The lock was opened for traffic November 27, 1903, and has been used regularly since. During the past year additional riprap has been placed for protecting bank below lock. Stone filling has been placed below lock to check erosion. Telephone line has been repaired. Several snags have been removed from approaches to lock.

(*b*) *Lock 8.*—This lock is about 63 miles by river below Tuscaloosa. Contract work was completed and this lock turned over to the United States in December, 1902. On January 1, 1903, its operation and care became a charge under the general law of July 5, 1884.

On account of delay in erecting the gates, damage to timber floor by upthrust, and a large leak which developed under abutment, this lock was not opened for traffic until October 13, 1903. Since that time it has been used regularly, except twenty-six days during November, 1904, when it was closed to traffic for repairs to timber floor, and a few days during January, 1906, on account of large accumulations of drift in upper approach to lock. During the past year three guard cribs have been built along upper approach to this lock. *Flood deposit* has been dredged from lock chamber. Caving banks *at and near the lock* have been protected with stone and quarry waste.

(*c*) *Lock 9.*—This lock is about 46 miles by river below Tuscaloosa. Contract work was completed and the lock turned over to the United States in December, 1902. On January 1, 1903, its operation and care became a charge under the general law of July 5, 1884. This lock was opened for traffic in October, 1902, and has been used regularly since. During the past year four guide cribs have been built along upper approach to lock. Upper approach to lock widened and straightened by dredging. Several large trees which caved into channel above and below lock removed by blasting and with derrick boat. Lock tender's house painted.

(*d*) *Locks 10, 11, and 12.*—These locks and dams are near Tuscaloosa, Ala., and overcome the Tuscaloosa Falls with their combined lift of 29 feet. They were finished and opened to traffic in November, 1895, and on July 1, 1896, their operation and care became a charge under the general law of July 5, 1884. In addition to their operation and care, flood deposit has been dredged from lock chambers and approaches. Wells have been drilled at Locks 10 and 11, furnishing an abundant supply of good water. Necessary repairs to plant have been kept up at the Tuscaloosa shops, and four barges have been hauled out on the ways and thoroughly repaired.

(*e*) *Lock 13.*—This lock is about 9 miles above Tuscaloosa. Contract work was completed and the lock turned over to the United States in May, 1905. On July 4, 1905, it was opened for traffic and its operation and care became a charge under the general law of July 5, 1884. Since that time two additional guide cribs have been built above the lock and the river bank below dam abutment thoroughly protected with riprap. During the past year in addition to operating and care of lock, fence has been built around reservation. Snags and obstructions have been removed from channel below lock. Lower approach to this lock has been widened and straightened by dredging.

During the past year, in addition to work on locks, about 40 miles of river between Locks 9 and 10 were cleared of snags and other obstructions. A channel was dredged through Trussells bar, which had shoaled up badly during the high-water season. One new work barge was built and all material delivered for one more. Steamer *Nugent* and dredge boat repaired and painted. Quarterboat repaired.

To June 30, 1908, the amount expended on this work was $315,693.76.

The total expense during the year for operating, repairs, etc., for the seven locks was $55,974.58.

The commerce passing through the locks during the fiscal year ending June 30, 1908, amounted to 1,496 tons coal, 202 tons cotton, 12,089 tons stone, 110 tons fertilizer, 5,634 tons logs, 785 tons lumber, and 350 tons of general merchandise. In addition to the commerce passing through the locks there is some coal traffic in the pool between Locks 12 and 13 and a considerable traffic in logs in the pool between Locks 7 and 8. No accurate record of this traffic is available.

(See Appendix R 4.)

5. Pascagoula River, Mississippi.—Before this improvement was commenced the channel through the bar at the mouth of the river had a least depth of 3 feet at low water, while inside the mouth for a distance of 10 miles upstream the river was navigable for vessels of

6½ feet draft. Appropriations for this work of improvement were made in 1827, 1828, and 1852, but there is no record of the work accomplished with those funds.

The first extended project for the improvement of this stream was adopted in 1880 and contemplated securing a channel 7 feet deep and 200 feet wide across the bar at the mouth of the river. This project also included some snagging work on the river above Moss Point, which is described in the report on the improvement of the Pascagoula, Leaf, and Chickasahay rivers, Mississippi. The project for a 7-foot channel was practically completed in 1884, the total amount expended in securing such a channel, including the appropriations made between 1827 and 1852, amounting to $74,500.

In 1886 a new project was adopted, which provided for securing a channel 12 feet deep at low water, with a navigable width between Mississippi Sound and Moss Point. Under this project a depth of 9 feet across the entrance bar was first obtained, while subsequently a channel 12 feet deep and 80 feet wide was dredged from Moss Point to the mouth of the river, and a 12-foot channel across the bar at the mouth was partially completed. These operations required the expenditure of $95,000, including the expenditure of about $8,000 applied to dredging work in Horn Island Pass in 1897, or a total of $169,500 under both projects.

The present project for the improvement of Pascagoula River was adopted in the river and harbor act of March 3, 1899, and provided for the formation of a 12-foot channel from a point in Dog River 3 miles above its mouth down the Pascagoula River to the 12-foot contour in Mississippi Sound, 150 feet wide above and 300 feet wide below the railroad bridge at Scranton, Miss., at an estimated cost of $317,600, including the formation of a 20-foot channel through certain shoal spots in the Horn Island anchorage.

Work under this project was in progress between September, 1899, and February, 1902, during which time an uninterrupted 12-foot channel was obtained within the limits of the project in Pascagoula River, while a 20-foot channel was formed through the shoal areas in Horn Island anchorage.

The river and harbor act of June 13, 1902, modified and extended the existing project so as to provide for a channel 17 feet deep instead of 12 feet from 3 miles above the mouth of Dog River to Mississippi Sound, at a total cost of $1,050,222, exclusive of the Horn Island improvement.

The total amount expended on the existing project up to the close of the fiscal year ending June 30, 1908, was $553,997.01, excluding the expenditure of about $88,000 on the work performed at Horn Island. Of this amount $65,044.68 was applied to maintenance. The whole expenditure of the past year may be charged to maintenance. Work under the project is about 50 per cent completed.

The U. S. dredge *Barnard* was tried for a short time in this channel and removed 80,394 cubic yards of material, place measurement. Bids, to be opened July 20, 1908, have been invited for dredging under contract in the upper part of the channel. The *Barnard* will be used in dredging the seaward end.

The full depth of 17 feet over a length of 60,002 feet of the channel for a width varying from 125 to 150 feet was finished in 1907, com-

pleting the work above the railroad bridge. During the past fiscal year about 1½ miles of the lower channel shoaled to 13 feet.

The available low-water draft is now 15 feet. The average range of tide is 1¾ feet.

It is proposed to apply the available balance and future appropriations toward the completion of the project and maintenance of the improvement.

A reference to the report of the survey upon which the existing project is based is printed in the Annual Report of the Chief of Engineers for 1904, page 334. An account of this improvement is contained in the Annual Reports for 1902, page 2211, and 1904, page 1828.

The commerce of the harbor for the calendar year 1907 amounted to 1,002,098 tons, principally logs, lumber, and naval stores, valued at $7,729,669.

This project results in effecting a reduction in rail freight rates between Scranton, Miss., and seaboard cities of the Atlantic coast, and also in affording direct water freight rates on lumber from Moss Point and Scranton to foreign ports.

July 1, 1907, balance unexpended	$150,652.01
June 30, 1908, amount expended during fiscal year for maintenance of improvement	25,044.68
July 1, 1908, balance unexpended	125,607.33
July 1, 1908, outstanding liabilities	1,500.00
July 1, 1908, balance available	124,107.33
Amount (estimated) required for completion of existing project	360,622.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	250,000.00

(See Appendix R 5.)

6. Pascagoula, Leaf, and Chickasahay rivers, Mississippi.—(a) Pascagoula River (above the mouth of Dog River).—Before this improvement was commenced navigation was impossible on this section of Pascagoula River, except during periods of high water. The minimum width of the channel was 60 feet and the minimum depth was 1 foot, the stream being very much obstructed by snags and logs. The first project for this improvement, which was adopted in 1880, in addition to providing for dredging work at the mouth of the stream, described in the report on the improvement of Pascagoula River, Mississippi, contemplated the improvement of the river by the removal of snags and overhanging trees. Under this project the river was cleared of obstructions between 1882 and 1884, at a cost of $15,000. In 1886 the existing project for this improvement was adopted. This project provides for the maintenance of the channel above the mouth of the river by removal of obstructions from the stream from time to time. This project was modified in 1899, the extent of the improvement being limited at that time to the section of the river above Dog River, about 100 miles. The total amount expended on the existing project to June 30, 1908, was $23,303.47, all of which was applied to maintenance.

A few obstructions were removed during the fiscal year. A contract has been made for the construction of a self-propelling snag boat, part of the cost of which will be paid from appropriation for this work, part from that for Leaf River, and the balance from the appropriation for improving Tombigbee River, mouth to Demopolis.

On June 30, 1908, the Pascagoula River was navigable at low water for boats of 5 feet draft as far up as Cedar Creek, 55 miles, while above this point to the head of the river light-draft navigation was possible on a slight rise above low water.

The Pascagoula River is nontidal, except in its lower reaches.

The report of the examination upon which the improvement was originally based is printed in the Annual Report of the Chief of Engineers for 1879, page 835.

The commerce originating on Pascagoula River above the mouth of Dog River during the calendar year 1907 amounted to 290,327 tons, principally logs, naval stores, and general merchandise, valued at $1,807,500. In addition to this, the combined commerce of Chickasahay and Leaf rivers passed over this stream.

This project has no effect on freight rates.

Available funds and future appropriations will be applied to part payment on snag boat and in continuation of snagging operations.

July 1, 1907, balance unexpended	$9,731.86
June 30, 1908, amount expended during fiscal year for maintenance of improvement	285.33
July 1, 1908, balance unexpended	9,446.53
July 1, 1908, amount covered by uncompleted contracts	6,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*b*) *Leaf River.*—Originally it was impracticable to navigate this river on account of snags, logs, and overhanging trees obstructing the channel. The minimum width of the stream was 100 feet and the minimum depth was 2½ feet. The original project for this improvement was adopted in 1890, its purpose being to afford a channel for high-water navigation from Bowie Creek to the mouth of the river, a distance of 75 miles, by the removal of obstructions and overhanging trees. This project was completed in 1897 at a cost of $11,019.04, since which time expenditures have been in the direction of maintaining the improvement.

No work was done during the fiscal year.

With available funds and future appropriations maintenance work will be continued.

The total amount expended on this improvement up to June 30, 1908, was $22,083.51, of which $11,064.47 was applied to maintenance.

On June 30, 1908, the river was available for rafting on a fair rise above low water, being used to a very limited extent for any other form of navigation.

For reference to the report upon which this project is based and to descriptions of the improvement, see the Annual Report of the Chief of Engineers for 1904, page 337.

[a] See consolidated money statement on page 412.

The commerce of Leaf River during the calendar year 1907 amounted to 177,750 tons, principally logs and timber, valued at $830,000.

This project has no effect on freight rates.

July 1, 1907, balance unexpended	$3,541.49
June 30, 1908, amount expended during fiscal year for maintenance of improvement	125.00
July 1, 1908, balance unexpended	3,416.49
July 1, 1908, amount covered by uncompleted contracts	1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

(*c*) *Chickasahay River.*—The original condition of this river was such that it was navigable for small rafts only during high water, and even navigation of this character was troublesome and dangerous. The minimum width of the channel was 50 feet and the minimum depth 6 inches, the river being badly obstructed by logs and snags.

The original project for the improvement was adopted by the river and harbor act of September 19, 1890, and provided for obtaining a high-water channel from the mouth of the river up to Shubuta, Miss., a distance of 130 miles, by the removal of obstructions from the channel and overhanging trees from the banks. The river and harbor act of June 3, 1896, modified this project by limiting the improvement to that part of the river between the mouth and Bucatunna, Miss., about 75 miles. The project further provided for the maintenance of the improved channel. The project, as modified, was completed in the latter part of 1896, at a cost of $12,399.73.

During the fiscal year ending June 30, 1904, the entire improvement was worked over, this work being completed October 19, 1903, leaving the river in fair condition for rafting and flatboats on a rise of 3 or 4 feet. No work was done after this until the past fiscal year, when the improvement was gone over and 7,372 obstructions were removed, resulting in considerable benefit to navigation.

The total amount expended on the improvement up to June 30, 1908, was $24,877.46, of which $12,477.73 was applied to maintenance.

The existing project was adopted in the river and harbor act of March 3, 1905, and provides for maintaining the channel in Chickasahay River from the mouth to Bucatunna, Miss., by the removal of logs, snags, and other obstructions from the waterway, in order to keep the river in navigable condition for rafting at high-water stages, at an annual cost of $2,500. A reference to the report of the examination upon which this project is based is printed in the Annual Report of the Chief of Engineers for 1905, page 346.

This stream is nontidal, and its condition on June 30, 1908, was such that it could be used by flatboats and rafts on a rise of 6 or 8 feet up as far as Shubuta, Miss., though considerably obstructed.

The improvement has had no effect on freight rates.

The commerce of this river during 1907 amounted to 180,125 tons of logs and timber, valued at $923,000.

[a] See consolidated money statement on page 412.

Available funds and future appropriations will be applied to snagging operations.

July 1, 1907, balance unexpended	$3,500.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,127.46
July 1, 1908, balance unexpended	372.54
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

CONSOLIDATED.

July 1, 1907, balance unexpended	$16,773.35
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,537.79
July 1, 1908, balance unexpended	13,235.56
July 1, 1908, amount covered by uncompleted contracts	7,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	25,000.00

(See Appendix R 6.)

7. *Horn Island Pass, Mississippi.*—The channel through the bar had before improvement a depth which increased through natural causes from 14 or 15 feet in 1853 to about 18 feet in 1886, and has been available at low water since the latter date for vessels up to a draft of slightly less than 18 feet.

Under the appropriations for improving Pascagoula River, Mississippi, carried by the river and harbor acts of August 18, 1894, and June 3, 1896, provision was made for the removal of the bar in Horn Island Pass, and in conformity with this provision a channel with a least depth of 20.5 feet (19.5 feet referred to the existing datum), and with a width of 200 feet, was dredged through the Horn Island bar. The total cost of this work was $7,682.40, but the benefit of the improvement was soon lost through shoaling.

Under the appropriations for Pascagoula River and Horn Island Harbor carried by the river and harbor act of March 3, 1899, and the sundry civil act of June 6, 1900, an amount estimated at about $88,000 was applied to dredging a 20-foot (19 feet present datum) channel at certain shoal areas in the Horn Island anchorage basin, the work being in progress between 1899 and 1901.

The existing project for the improvement of Horn Island Pass provides for the formation of a channel 21 feet deep at low water, 300 feet wide through the outer bar, and 200 feet wide elsewhere in the pass, at an estimated cost of $40,480, and $9,000 annually to preserve the improvement. The project was adopted by the river and harbor act of March 3, 1905, which carried an appropriation of $40,480 for the work, subject to the condition "that a contract or contracts can be

[a] See consolidated money statement on this page.

made at a sum not to exceed the unit price of eleven cents per cubic yard, or such work can be performed by a Government dredge."

The proposed dredging work was advertised under date of May 16, 1905, but no bids for its execution were received in response to this advertisement. Since that date the work has been performed by the U. S. dredge *Charleston*. Previous to June 30, 1907, this dredge removed 353,230 cubic yards of material at a cost of 9 cents per cubic yard. During the past fiscal year she removed 184,017 cubic yards of material at a cost of 8.82 cents per cubic yard. The saving to the United States over contract work is estimated at $9,528.48. This dredge is in need of repairs, as explained in report on Mobile bar, and it is proposed to pay for one-half the cost of these repairs from the appropriation for Horn Island Pass.

The project has been completed and available funds and future appropriations will be applied to maintenance of the channel and to the payment of part of the cost of repairing the dredge *Charleston*.

The report upon which this project is based is printed in the Annual Report of the Chief of Engineers for 1904, page 1863.

The available low-water depth through the pass is about 21 feet, and the average range of tide is about 1.1 feet.

Commerce using the Horn Island Pass channel during the calendar year 1907 amounted to 510,366 tons of lumber and timber, valued at $4,694,169.

This improvement in connection with the improvement of Pascagoula River results in effecting a reduction in rail freight rates between Scranton, Miss., and seaboard cities of the Atlantic coast, and in affording direct water freight rates on lumber from Moss Point and Scranton to foreign ports.

The total amount expended under the existing project up to June 30, 1908, was $45,986.57, of which about $5,505.57 has been applied to maintenance.

July 1, 1907, balance unexpended		$19,782.33
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$10,783.33	
For maintenance of improvement	5,505.57	
		16,288.90
July 1, 1908, balance unexpended		3,493.43
July 1, 1908, outstanding liabilities		827.55
July 1, 1908, balance available		2,665.88
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		14,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix R 7.)

8. Harbor at Biloxi, Miss.—This channel originally had a minimum depth of 4 feet. The original project for its improvement was adopted in 1882 and contemplated the formation of a channel through Deer Island flats to connect Biloxi Bay with the Back Bay of Biloxi, at an estimated cost of $35,000. The channel thus proposed was to have a depth of 8 feet at low water, with a width sufficient for navigation.

In 1884 this project was changed so as to provide for deepening the channel from Mississippi Sound to the wharves at Biloxi from the existing depth of 4 or 4½ feet to 8 feet over a width of 150 feet, the estimated cost of this work being $55,000. The work of dredging was commenced in September, 1887, and the project was finally completed in August, 1893, at a cost of $44,382.27. Between this time and June 30, 1907, maintenance dredging was carried on from time to time by contract, keeping the improvement partially intact.

Under contract 62,370.6 cubic yards of material, place measurement, was dredged during the year, restoring the depth of 8 feet over a width of 120 feet and a length of 6,666 feet. The contract price was 12¾ cents per cubic yard measured in place. Other expenses amounted to 1.72 cents per cubic yard.

Available funds and future appropriations will be applied to maintaining a channel 8 feet deep and as great a width as possible, not exceeding 150 feet.

The commerce of the harbor during the calendar year 1907 consisted principally of lumber, rosin and turpentine, fish and oysters, and general merchandise, amounting to 271,580 tons, valued at $2,667,050.

The total amount expended on this improvement up to June 30, 1908, was $71,083.66, of which $26,701.39 was applied to work of maintenance.

The maximum low-water draft that can be carried through the channel is now about 9 feet, and the range of tide is about 1¾ feet.

A reference to the report upon which the present project for this work of improvement is based is printed in the Annual Report of the Chief of Engineers for 1904, page 337.

The project has little or no effect on freight rates.

July 1, 1907, balance unexpended	$10,696.53
June 30, 1908, amount expended during fiscal year for maintenance of improvement	9,397.92
July 1, 1908, balance unexpended	1,298.61
July 1, 1908, outstanding liabilities	500.00
July 1, 1908, balance available	798.61
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix R 8.)

9. Harbor at Gulfport and Ship Island Pass, Mississippi.—Originally no channel existed between Ship Island Harbor and Gulfport, Miss. The depths on the site of the channel ranged from 19 to 8½ feet, and over the site of the anchorage basin they varied from 8½ to 2½ feet.

The existing project was adopted by the river and harbor act of March 3, 1899, which authorized the Secretary of War to enter into contract for dredging a channel 300 feet wide and 19 feet deep at mean low water from the anchorage basin at Ship Island Harbor, on the Gulf of Mexico, to Gulfport, Miss., and to construct at the end of this channel next to the shore an anchorage basin of similar depth

and not less than 2,640 feet by 1,320 feet in area. This act also authorized the Secretary of War to contract for the maintenance of this channel and anchorage basin for a term of five years after their completion for the sum of $10,000 annually.

Contract was entered into in 1901 for dredging the channel and anchorage basin, the work to be completed within two years from April 21, 1901, for $150,000, and for the maintenance of the channel and basin for a term of five years after completion for the sum of $10,000 per annum. Work was commenced on April 16, 1901. By joint resolution of Congress approved June 14, 1906, it was provided that the channel and basin should be accepted as dredged, and that $150,000 should be paid the contractor for the work, the channel and basin having been dredged to the approximate depth and width required in the contract. The payment has been made. The period of maintenance commenced June 14, 1906.

The river and harbor act approved March 2, 1907, appropriated $100,000 for continuing the improvement and maintenance of the anchorage basin at Gulfport and channel therefrom to the anchorage or roadstead at Ship Island, also Ship Island Pass between Ship and Cat islands, Mississippi, and authorized the Secretary of War to annul that portion of the contract entered into February 20, 1901, with Spencer S. Bullis, relating to the maintenance of a channel and anchorage basin between Ship Island and Gulfport. The annulment of this contract was effected by a supplemental agreement approved by the Secretary of War June 11, 1907.

Since March 2, 1907, nothing has been done at Ship Island Pass, and no work on this channel is proposed for the present.

During the past fiscal year the U. S. Dredge *Barnard* has dredged 1,298,144 cubic yards of material, place measurement, from the Gulfport channel, at a cost of $66,534.81, and has proved fairly successful for this work. The district officer points out the abuse of this channel, the difficulties of this work, the necessity for a special dredge, and recommends the transfer of the *Barnard* and attendant plant, with some alterations and additions, at a total estimated cost of $215,000, should a dredge be provided for this channel.

The maximum low-water draft available in the channel and basin is 19 feet. The range of tide here is about 1¾ feet. Vessels drawing over 20 feet are dragged out by tugs through the mud at the bottom of the channel.

During the time dredging work was in progress under contract with Spencer S. Bullis allotments, amounting to $24,199.85, were made from the permanent indefinite appropriation made by section 4 of the river and harbor act of July 5, 1884, to cover the expenses of inspection, superintendence, and surveys. Of the amount allotted, $22,449.76 was applied to the purpose for which intended and the balance turned back into the Treasury.

It is proposed to apply available funds and future appropriations to maintenance of the Gulfport channel and anchorage basin.

A reference to the report upon which the present project is based can be found in the Annual Report of the Chief of Engineers for 1904, page 338.

The commerce of Gulfport Harbor during the calendar year 1907 amounted to 670,606 tons, principally lumber and timber, valued at $6,969,600.

This project results in effecting a reduction in rail freight rates between Gulfport and seaboard cities of the Atlantic coast and in affording water freight rates from Gulfport to foreign ports.

The total amount expended on this improvement up to June 30, 1908, was $238,582.90, of which $72,383.05 was applied to maintenance.

July 1, 1907, balance unexpended	$97,151.76
Returned to Treasury to credit of appropriation for operating and care of canals, etc	1,750.09
	95,401.67
June 30, 1908, amount expended during fiscal year for maintenance of improvement	66,534.81
July 1, 1908, balance unexpended	28,866.86
July 1, 1908, outstanding liabilities	10,600.00
July 1, 1908, balance available	18,266.86
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	200,000.00

(See Appendix R 9.)

10. Wolf and Jordan rivers, Mississippi.—The least depth on the bar at the mouth of Wolf River is something under 3 feet, and on the bar at the mouth of the Jordan River it is not quite 4 feet.

The present and only project was adopted by the river and harbor act of March 2, 1907, and provides for the formation of a channel 7 feet deep and 100 feet wide at bottom, with side slopes of 1 on 6, across the bar at the mouth of each of the streams named, from the 7-foot curve of depth in the river to the 6-foot contour in Bay St. Louis, at a cost of $30,000 for completing the work and $5,000 per annum thereafter for maintenance. After reaching the 6-foot contour in the bay, the material becomes so soft that a draft of 7 feet can easily be carried through it. A contract has been entered into for dredging channels in accordance with the project, and 161,163.2 cubic yards of material, place measurement, was removed during the year, resulting in a channel in the Wolf River 8 feet deep and 100 feet wide between the 6.7-foot and the 5.3-foot curves, and a channel of the same width and depth in Jordan River between the 6.7-foot and the 5.5-foot curves. The project is about 95 per cent completed.

A mean low-water draft of 7 feet can be carried through either channel, and the average range of the tide is 1¾ feet.

Additional appropriations, when made, will be applied to maintenance.

The report of the examination and survey upon which the project is based is printed in House Document No. 917, Fifty-ninth Congress, first session. For previous reports of examinations, reference is made to the Annual Report of the Chief of Engineers for 1893, pages 1787 and 1789.

The commerce on these rivers during the calendar year 1907 amounted to 43,282 tons of lumber, rosin, turpentine, and general merchandise, valued at $478,041.

The improvement has been of immediate and considerable local benefit. The work is too recent to determine its effect on freight rates, but it is believed to have little, if any, such effect.

The total amount expended on this improvement up to the close of the past fiscal year was $28,695.19, none of which was applied to maintenance.

July 1, 1907, balance unexpended	$30,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	28,695.19
July 1, 1908, balance unexpended	1,304.81
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix R 10.)

11. Pearl River below Rockport, Miss.—The limits of this improvement originally extended from the mouth of the river to Jackson, a distance of 313 miles. By act of Congress of April 21, 1900, the construction of a fixed highway bridge across Pearl River at Rockport was legalized. This point thereby became the head of navigation on the lower river for boats of any considerable size and the upper limit of the project. However, the bridge at Rockport is reported to have been washed away in February, 1906. The distance from Jackson to Rockport is 67 miles.

Prior to improvement the condition of the river was such that it was not navigable except during high-water stages, and even then navigation was difficult and dangerous.

The original project for this improvement was adopted in 1880, and provided for a channel of navigable width and 5 feet deep at low water, by the removal of snags and sunken trees from the river bed and overhanging trees from the banks, at an estimated cost of $95,940. This project having been found to be impracticable, it was modified in 1885 so as to provide for a 2-foot channel at low water throughout this section of the river, at an estimated cost of $145,940.

With past appropriations the river has been improved until it became navigable for light-draft boats on a slight rise up as far as Monticello, about 211 miles above the mouth. Above Monticello the river has never been navigable except on a rise of 7 feet or more. Appropriations since 1899 have been applied to the maintenance of the lower 100 miles of the river.

During the past fiscal year 40 miles of river was worked over with the snag boat *Pearl*, most of it twice; 10,878 obstructions were removed. The work of equipping the *Pearl* with self-propelling machinery is just about completed, and she will shortly resume the work of removing obstructions.

The total amount expended on this improvement up to June 30, 1908, was $176,210.13, of which about $71,085.13 was applied to maintenance.

Recent appropriations, prior to that of March 2, 1907, were sufficient only to maintain the channel in the lower 100 miles, and this part is available for light-draft navigation on a fair rise. The up-

per portions of the stream not recently worked over are not safe for navigation on less than a 7 or 8 foot rise.

The redredging of the 9-foot channel at the mouth of East Pearl River, as recommended in House Document No. 328, Sixtieth Congress, first session, should, it is believed, be considered a separate improvement, and none of the money for Pearl River below Rockport should be applied to it.

It is proposed to apply available funds and future appropriations to the prosecution of snagging work in completion of the project and maintenance of the improvement.

This river is nontidal except in its lower reaches.

The report upon which the project was originally based can be found in the Annual Report of the Chief of Engineers for 1879, page 879. Extended information can be found in the Annual Report of the Chief of Engineers for 1896, page 1454.

The commerce of this part of Pearl River during the calendar year 1907 amounted to 40,887 tons of logs and timber, valued at $422,247.

The project has little or no effect on freight rates, but when completed it is believed will cause a material reduction in these charges.

July 1, 1907, balance unexpended	$29,182.32
June 30, 1908, amount expended during fiscal year for maintenance of improvement	4,981.06
July 1, 1908, balance unexpended	24,201.26
July 1, 1908, outstanding liabilities	6,200.00
July 1, 1908, balance available	18,001.26
Amount (estimated) required for completion of existing project	75,798.74
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	20,000.00

(See Appendix R 11.)

12. Pearl River between Edinburg and Jackson, Miss.—The original condition of this section of Pearl River was such that navigation was impossible, except during high water, and even at high stages it was difficult and dangerous. The minimum width and depth of the channel was 40 feet and 1 foot, respectively, between Carthage and Jackson, while above Carthage the channel had a minimum width of 30 feet and a minimum depth of 3 inches. This improvement was formerly divided into two sections, for which appropriations were made separately. The original project for the section from Jackson up to Carthage, 101 miles, as adopted in 1879, contemplated obtaining a clear channel of navigable width and 5 feet depth at low water, at an estimated cost of $21,000. In 1886 this project was modified so as to provide for a channel 2 feet deep, this depth being considered sufficient for the needs of navigation, and at the same time the estimate of cost was increased to $50,000. Work under this project was completed in 1893, at a total cost of $26,014.98, since which time funds have been applied to maintenance.

The original project for the part of the river from Carthage up to Edinburg, a distance of 25 miles, was adopted in 1884 and provided

for the formation of a high-water channel for use during six or eight months of the year, at an estimated cost of $13,464, and for the maintenance of same at an annual cost of $500. The work of improvement under this project was completed in 1890, at a cost of $5,857.08, subsequent appropriations being applied to the work of maintenance.

The river and harbor act approved June 13, 1902, made one appropriation for this section, since which it has been considered as a single improvement and appropriations made accordingly.

Snagging operations were resumed July 13, 1907, and discontinued December 30, 1907, on account of high water, 71½ miles of river having been worked over and 8,339 obstructions removed. This work will be continued with available funds and future appropriations as made.

Up to June 30, 1908, the total amount expended on this improvement was $63,850.31, of which about $31,978.25 had been applied to maintenance.

The report of the survey of Pearl River from Carthage to Jackson, upon which the present project was based, is published in the Annual Report of the Chief of Engineers for 1879, page 880, and the report of the survey of the river between Edinburg and Carthage, upon which the present project was based, is printed in the Annual Report of the Chief of Engineers for 1884, page 1287.

During the calendar year 1907 there was quite a commerce on this section of Pearl River, but the only definite figures received at this office was 340 tons of general merchandise, valued at $10,000.

The improvement has had no effect on freight rates.

July 1, 1907, balance unexpended	$4,734.71
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,285.02
July 1, 1908, balance unexpended	2,449.69
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix R 12.)

13. Dredge for harbors on coast of Mississippi.—The river and harbor act of March 2, 1907, authorized the Secretary of War, in his discretion, to construct a dredge for use in said harbors and the channels adjacent thereto, at a cost not exceeding $200,000, of which amount, in case such dredge were constructed, $25,000 should be taken from the appropriation for Gulfport Harbor and $50,000 from the appropriation for Pascagoula River. These amounts have been transferred to the credit of the dredge, and the balance of its proposed cost, $125,000, was appropriated by the sundry civil act of May 27, 1908.

The Secretary of War on April 24, 1908, authorized the construction of this dredge. Plans and specifications have been prepared and work commenced on designing the attendant plant. The comp tons of the investigation of a type of dredge for Mobile Bay d by the with the completion of the design for this dredge, and it2 was paid that the two dredges and attendant plant would be so nepriation for that they could with saving, both in first cost of

July 1, 1907, balance unexpended	$21,029.92
June 30, 1908, amount expended during fiscal year	21,029.92

(See Appendix S 1.)

2. *Southwest Pass, Mississippi River.*—On February 17, 1898, Congress allotted $10,000 from the appropriation for closing crevasse in Pass a Loutre, Mississippi River, for the purpose of a survey and report by a Board of Engineer officers upon the practicability of securing a channel of adequate width and 35 feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass, Mississippi River. The survey was completed in 1898 and report submitted on January 7, 1899. This report is printed in the Annual Report of the Chief of Engineers for 1899, page 1863.

The item in the river and harbor act approved March 3, 1899, making appropriation for improving outlet of the Mississippi River provided for the appointment of a Board of Engineers to prepare a project for a channel 35 feet in depth throughout Southwest Pass and appropriated $20,000 for expenses of the Board. The Board of Engineers appointed under provisions of this act submitted a report and project on January 11, 1900. The report is printed on pages 2287–2302 of the Annual Report of the Chief of Engineers for 1900.

The project of the Board contemplated securing a channel 1,000 feet wide and 35 feet deep at mean low water throughout the Southwest Pass by dredging; the construction of two jetties to maintain the channel; the construction of sills across Cubits Gap, The Jump, and Baptiste Collets Canal; the closing of all minor outlets below the forts; the construction of a dredge in addition to the one provided for by the river and harbor act of March 3, 1899, and the sundry civil act of June 6, 1900, under appropriation for improving outlet of the Mississippi River; other necessary plant, such as tugboats, barges, tracks, buildings, etc., and the purchase of land at the shore ends of the jetties; the whole estimated to cost $6,000,000, and $150,000 additional per annum for maintenance.

This project was adopted by the river and harbor act of June 13, 1902, which authorized material modifications in the plans of the jetties, and they are now located as shown on the map printed with Appendix S 2 of this report.

By act of May 28, 1908, Congress authorized the use of funds from this appropriation in dredging shoals in the river between Cubits Gap and Head of Passes, when necessary to secure a depth of 35 feet with a practical width. The sum of $3,500,000 had been appropriated, and the river and harbor act of March 2, 1907, appropriated $1,000,000 additional, and authorized contracts to the further amount of $1,500,000, of which $330,000 is yet to be appropriated.

The original project for the expenditure of the funds appropriated for this work contemplated the construction of a dredge, dredging, purchase of land, and construction of two jetties to be built of mattresses and stone with concrete superstructure.

All of the land below or south of Pilottown, on the east bank, and all that below the United States reservation on the west bank of Southwest Pass, containing about 1,275 acres, were acquired on July 10, 1903, for use in connection with the work.

Contract was entered into July 16, approved July 31, 1903, for construction of the two jetties. The laying of foundation mats in the east jetty was commenced on December 31, 1903, and in the west jetty

on August 30, 1904. The work under this contract was completed on January 5, 1908.

To June 30, 1908, about two-thirds of the approved project had been accomplished. The jetties were completed. The laying of sills across Cubits Gap and The Jump and additions to the sill across Pass a Loutre was completed. The coaling station and wharf at Southwest Pass were built. Foundations for the office and sixteen dwellings were constructed. Dredging by contract and by Government dredges has been carried on and is still being prosecuted. In September, 1904, the available depth at mean low water was 8 feet. On June 30, 1908, the channel would accommodate a maximum draft of 23 feet, but the obstruction to a 25-foot draft was for a distance of only 130 feet, and with this exception the channel was 25 feet deep with a least width of 400 feet.

Usual variations of water surface, 1.5 feet.

The length of Southwest Pass from its head to the present sea ends of the jetties is 19 miles.

The amount expended on this work to June 30, 1908, was $3,974,-922.83.

On account of the advance of the crest of the bar at Southwest Pass since the date of the survey of 1898, on which the estimates for this improvement were based, it became necessary to make provision for increasing the length of the jetties to correspond with this advance. This was done by supplemental contract dated July 18, 1905, the increased cost of the jetties on this account being estimated at $465,000.

The amount of money available and pledged and not covered by contracts at the end of the fiscal year is about sufficient to cover the cost of dredging with two dredges, expenses of administration and inspection, and reasonable contingencies. As recognized by the Board on Southwest Pass in its report of January 11, 1900, and as since borne out by experience, this work is "one more than ordinarily liable to special difficulties which do not admit of calculation, such as the effect of storms, unfavorable foundations, and uncertain action of the river current," and the amount of funds available for contingencies should be unusually large.

It is proposed to apply the additional appropriation asked for to the prosecution of dredging operations, by contract and otherwise, as may be found most economical and advantageous to the United States, with a view of obtaining a minimum depth of 35 feet at mean low tide, as contemplated by the original project; to the closing of the outlets in Southwest Pass; to the removal of the Eads sill at the head of the pass; to the construction of the plant that will be necessary in the maintenance of the improvement, and to the payment of other expenses pertaining to the general work of improvement under the approved project. The uninterrupted prosecution of dredging operations is of paramount importance; hence it is greatly desired that the funds be made available so that this work may be continued and completed as early as practicable. The amount asked for is the balance of the amount pledged by Congress for the work of improvement under this project.

The sum of $202,540.64 was applied during the year to construction of sill across Cubits Gap and The Jump and building up the sill across the head of Pass a Loutre, Mississippi River, details of

the work being given in the preceding report on closing crevasse in Pass a Loutre. Work under contract for dredging was begun November 13, 1907, and to the end of the fiscal year 633,954 cubic yards of material had been removed from section 1 and 1,008,239 cubic yards of material had been removed from section 2. The total amount earned by the contractors for work on these two sections was $216,-210.18. On account of difficulties experienced by the contractors in managing their pipe line in a strong current it became necessary to enter into a supplemental contract April 3, 1908, modifying the original contract so as to permit of payment to the contractors for the actual number of cubic yards of material removed from section 1, providing that before the river reaches a stage of 9 feet by the Carrollton gauge the contractor shall return to section 1 and remove all material so as to secure the full width of 500 feet at the bottom with natural slopes and full depth of 35 feet at mean low water. The consideration flowing to the United States under this supplemental contract was the reduction in price of material removed from 14 cents to 13 cents per cubic yard and a further reduction to 6½ cents per cubic yard for certain material dredged between 35 and 36 feet below mean low water.

Bids have been asked for constructing reenforced concrete buildings at Burrwood, La., but those received were rejected as excessive, and the work is being readvertised, bids to be opened July 8, 1908.

July 1, 1907, balance unexpended	$1,359,986.40
Amount appropriated by sundry civil act approved May 27, 1908	1,170,000.00
Miscellaneous receipts deposited to credit appropriation during fiscal year	128.74
	2,530,115.14
June 30, 1908, amount expended during fiscal year for works of improvement	857,269.82
July 1, 1908, balance unexpended	1,672,845.32
July 1, 1908, outstanding liabilities	58,529.07
July 1, 1908, balance available	1,614,316.25
July 1, 1908, amount covered by uncompleted contracts	288,600.82
Amount (estimated) required for completion of existing project	330,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	330,000.00

(See Appendix S 2.)

3. Examinations and surveys at South Pass, Mississippi River.—The act of Congress approved March 3, 1875, required examinations and surveys to be made at South Pass, Mississippi River, and reports upon the depth of water and width of channel secured and maintained from time to time in said channel, together with such other information as the Secretary of War might direct. Under the terms of the acts of August 11, 1888, and June 13, 1902, an annual appropriation of $10,000 is made available for this work. By act of May 28, 1908, Congress authorized the use of funds from this appropriation in dredging shoals in the river between Cubits Gap and Head of Passes, when necessary to secure a depth of 35 feet, with a practical width.

Up to January 29, 1901, the work of making examinations and surveys at South Pass was carried on under the provisions of the acts of March 3, 1875, and August 11, 1888. From January 29, 1901, to June 30, 1902, examinations and surveys were made with funds appropriated by act of June 6, 1900, for maintenance of South Pass channel.

Since June 30, 1902, under the act of June 13, 1902, repeated surveys have been made of the shoaler localities in South Pass. Complete surveys of the jetty channel and of the channel beyond the ends of the jetties to deeper water in the Gulf were made each month during the fiscal year. A detailed annual survey was made of the 14 miles of channel from the main river to deep water in the Gulf.

Discharge measurements were made of each of three passes during high water.

The expenditures during the year amounted to $10,450, including $1,500 outstanding liabilities at the beginning of the year, and were for services.

The total amount expended upon this work to June 30, 1908, was $412,222.97. These figures can not be taken as being absolutely accurate, because the records prior to the act of June 13, 1902, are somewhat confused and do not seem to have been kept in sufficient separate detail to show the exact expenditure for surveys in the early years of this improvement. The amount given may be accepted as within a few dollars of the actual expenditure.

Statement of expenditures on account of appropriation for examinations and surveys at South Pass, Mississippi River, from July 1, 1907, to June 30, 1908, inclusive, made in compliance with the river and harbor act of June 13, 1902.

Services	$10,450.00
APPROPRIATION FOR FISCAL YEAR 1907.	
July 1, 1907, balance unexpended	$1,500.00
June 30, 1908, amount expended during fiscal year	1,500.00
APPROPRIATION FOR FISCAL YEAR 1908.	
July 1, 1907, amount appropriated by river and harbor act of June 13, 1902, for fiscal year 1908	$10,000.00
June 30, 1908, amount expended during fiscal year	8,950.00
July 1, 1908, balance unexpended	1,050.00
July 1, 1908, outstanding liabilities	1,050.00
July 1, 1908, total cost of operations during fiscal year	10,000.00

(See Appendix S 3.)

4. Maintenance and improvement of South Pass channel, Mississippi River.—The act of Congress of March 3, 1875, amended by acts of June 19, 1878, and March 3, 1879, made provision for the construction by James B. Eads, or his representatives, of jetties and other works in South Pass to secure and maintain a channel 26 feet in depth through the pass, and through the jetties at the mouth of the pass channel "twenty-six feet in depth, not less than two hundred feet in width at the bottom, and having through it a central depth of thirty feet without regard to width." A contract was made for the maintenance of such channel for a period of twenty years.

On January 28, 1901, this contract expired, and the work of maintenance is being continued under the provisions of the emergency river and harbor act of June 6, 1900, which provides that at the termination of the contract with the representatives of the estate of James B. Eads, deceased, the Secretary of War shall take charge of

and maintain the channel, jetties, and auxiliary works at South Pass, for which a sum not to exceed $100,000 per year is appropriated until otherwise provided by law.

Additional appropriations amounting to $225,000 have since been made for the purchase of land at South Pass, for dredging, and for other necessary expenses to maintain the channel with the utmost efficiency. By act of May 28, 1908, Congress authorized the use of funds from this appropriation in dredging shoals in the river between Cubits Gap and Head of Passes, when necessary to secure a depth of 35 feet, with a practical width.

Dredging operations have been carried on with United States plant and the jetties and auxiliary works have been maintained in good condition by the addition from time to time, as required, of willows, stone, piles, and waling timber.

The lands along both sides of South Pass from Head of Passes to the Gulf, containing about 6,994 acres, together with the buildings thereon, were acquired by purchase July 8, 1903, the price paid being $35,000.

Experience has shown that in order to maintain the channel with the utmost efficiency and to meet the demands of the commerce of the port of New Orleans the amount of the annual appropriation authorized by the act of June 6, 1900, should be increased. If other funds than the $100,000 provided by the act of June 6, 1900, had not been available during the past fiscal year it would have been necessary to suspend dredging operations and the work of maintaining the channel would have been considerably curtailed. During the period that it is necessary to keep South Pass open to navigation, or until the commerce is diverted through Southwest Pass by the opening of that channel to navigation, the annual appropriation should be at least $150,000. It is believed that after the Southwest Pass is opened to navigation the work of maintaining the channel through South Pass may be discontinued.

The sum of $908,962.49 was expended on this work from January 29, 1901, to June 30, 1908.

Comparative statement of receipts and shipments for seven years for the port of New Orleans, La.

Year ending December 31—	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1901	4,213,869	1,440,224	.....
1902	3,385,686	.....	828,183
1903	3,062,506	.....	323,180
1904	2,853,926	.....	208,580
1905	3,478,976	625,050	.....
1906	4,023,156	544,180	.....
1907	3,527,097	.....	496,059

Since the United States took charge of the maintenance of the channel, January 29, 1901, there has been a general increase in the available navigable depth of 2 feet, the maximum draft that could be carried on June 30, 1907, being 28 feet.

The usual variation of level of water surface is from zero at the mouth to 2½ feet at the head of the pass, due to the stage of the river, and from 1.1 feet at the mouth to 0.7 feet at the head, due to tide.

No detailed data or statistics are at hand showing the effect on freight rates of the increased depth of channel. The number of deep-draft steamers has increased, and, being able to carry full cargoes, the earnings and business of the port of New Orleans have increased and the freight rates decreased. The magnitude of the commerce of the port of New Orleans is best illustrated by the tabulated commercial statistics above. These figures are necessarily incomplete, as it is impracticable to secure statements covering all the receipts and shipments for any given period. It may be safely assumed, however, that the total greatly exceeds that shown in the above comparative statement.

APPROPRIATION FOR FISCAL YEAR 1907.

July 1, 1907, balance unexpended	[a] $9,748.76
June 30, 1908, amount expended during fiscal year	9,748.76

APPROPRIATION FOR FISCAL YEAR 1908.

July 1, 1907, amount appropriated by emergency river and harbor act of June 6, 1900	$100,000.00
Miscellaneous receipts during fiscal year deposited to credit of the appropriation	2,292.69
Amount received from refundment of overpayment during fiscal year	40.63
	102,333.32
June 30, 1908, amount expended during fiscal year	88,144.14
July 1, 1908, balance unexpended	14,189.18
July 1, 1908, outstanding liabilities	14,189.18

APPROPRIATION FOR MAINTENANCE OF SOUTH PASS CHANNEL, MISSISSIPPI RIVER.

July 1, 1907, balance unexpended	$50,129.31
June 30, 1908, amount expended during fiscal year	34,327.14
July 1, 1908, balance unexpended	15,802.17
July 1, 1908, outstanding liabilities	13,509.80
July 1, 1908, balance available	2,292.37
Amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908, for maintenance of improvement, in addition to regular annual appropriation of $100,000. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[b] 50,000.00

MAINTENANCE OF SOUTH PASS CHANNEL, MISSISSIPPI RIVER, 1909.

Amount appropriated by sundry civil act of May 27, 1908	$50,000.00
July 1, 1908, balance available	50,000.00

(See Appendix S 4.)

[a] The amount stated as unexpended in the annual report for fiscal year ending June 30, 1907, was $9,748.76. To this should be added the sum of $14.98 collected from the Signal Corps for work done by the Engineer Corps in testing cables at South Pass, which was expended during the fiscal year ending June 30, 1908.

[b] In connection with the estimate of $50,000, submitted above, it may be stated that if the Southwest Pass is opened to navigation during the next fiscal year and the work of maintaining South Pass channel suspended, the additional appropriation may not be needed. However, to provide for all possible contingencies, it is considered best to have ample funds available for South Pass until Southwest Pass is open, in order that necessary dredging may be continued and the navigation of the channel unimpeded.

5. Bayou Lafourche, Louisiana.—Bayou Lafourche is an outlet of the Mississippi River, forming a junction 70 miles above New Orleans. It is about 105 miles long and flows into the Gulf of Mexico. In its original condition it was obstructed by logs, snags, and overhanging trees. The project of 1879 provided for the removal of such obstructions to improve low-water navigation. Work under this project was carried on until 1885, with appropriations aggregating $30,000.

The project of June 11, 1886, provided for the construction of a lock to connect the bayou with the Mississippi River and for dredging a channel 75 feet wide and 5 feet deep at mean low water of the Gulf, at an estimated cost of $450,000 and $8,000 annually thereafter for maintenance. Work under this project was confined to dredging to maintain low-water navigation, the appropriations at any one time being insufficient to warrant the commencement of the lock and the exigencies of commerce not permitting a suspension of the dredging.

The project of 1886 was modified on September 23, 1896, and held in abeyance the construction of the lock, restricting operations to dredging to maintain low-water navigation, at an estimated cost of $25,000 per annum.

Dredging operations have been in progress since 1896, but the improvement is not permanent, as sand bars form each year after the subsidence of floods in the Mississippi River.

The amount expended on this work up to June 30, 1908, was $258,085.17.

The navigation of Bayou Lafourche is at present obstructed by a dam placed across the head of the bayou at its junction with the Mississippi River by levee boards of the State of Louisiana, under authority of the act of Congress approved June 13, 1902. The time for the removal of this dam was extended to January 1, 1910, by the river and harbor act of March 2, 1907.

The sum of $5.50 was expended during fiscal year ending June 30, 1908.

In answer to complaint from the navigation interests, an investigation was made during July, 1907, of an old sunken barge in the navigable channel near Lockport, La. The barge was found to be an obstruction to navigation and had been abandoned. During this investigation it was found that other obstructions had been placed in the channel by private parties. They were ordered removed.

The maximum draft that can be carried on June 30, 1908, at mean low water is 3½ feet at the mouth, the usual variation of the water surface being between one-half and 1 foot. The bayou is navigable its entire length by flatboats and log rafts, but, as stated above, connection between the bayou and the Mississippi River is at present obstructed by a dam.

The commerce of this bayou is carried principally by two small gasoline boats that ply between New Orleans and points along the bayou. These boats reach New Orleans by the way of Barataria Canal, which is the shortest route. The carrying capacity of these small boats is ample for the demands of the present and prospective commerce, and the distance from points along the bayou through Barataria Canal to New Orleans being much shorter than through the Lafourche it is believed that navigation or commerce would not be benefited by opening and improving the bayou proper.

The effect of the project on freight rates is not definitely known.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	206,516	.....	62,882
Calendar year—			
1899	157,258	.....	49,258
1900	210,315	53,057	.....
1901	137,357	.....	72,958
1902	132,745	.....	4,612
1903	94,351	.....	38,394
1904	66,839	.....	27,512
1905	94,320	27,481	.....
1906	59,092	.....	42,228
1907	46,413	.....	12,679

July 1, 1907, balance unexpended	$1,920.33
June 30, 1908, amount expended during fiscal year, for maintenance	5.50
July 1, 1908, balance available	1,914.83

(See Appendix S 5.)

6. Bayou Teche, Louisiana.—Bayou Teche is an important commercial stream of southern Louisiana, and finds its outlet into the Gulf of Mexico through Atchafalaya River. Prior to improvement it had a depth of 8 feet to St. Martinville, La., but navigation was rendered dangerous by numerous obstructions. Above St. Martinville the bayou was navigable by steamboats during high water. The project of 1870 provided for removal of obstructions from the head to the mouth of the bayou. Work under this project was carried on from 1870 to 1886, the stream being cleared of logs, snags, wrecks, overhanging trees, and a number of bars. The improvement was not permanent and other obstructions formed.

The project of 1891 provided for the removal of obstructions between St. Martinville, La., and the mouth of the bayou, a distance of about 80 miles. Work under this project has been carried on since 1891, obtructions being removed as appropriations were made.

The project was modified by the river and harbor act approved March 2, 1907, with a view to obtaining a 6-foot navigation to Arnaudville, in accordance with the report submitted in House Document No. 527, Fifty-ninth Congress, first session, at an estimated cost of $111,000, by dredging, removal of snags, etc., and construction of a lock. The expenditure for a 6-foot navigation to Arnaudville is contingent upon all lands necessary for lock and dam purposes and canal feeders being deeded to the United States free of cost and upon the United States being secured against possible claims for damages resulting from the overflow of lands by reason of the lock and dam improvement or from the drainage of Spanish Lake.

Proportion of project completed: To June 30, 1908, no work of construction had begun. All allotments for maintenance were expended in dredging and removing wrecks, the distance dredged being 10,985 feet, resulting in obtaining a channel of from 5 to 6 feet deep. The maximum draft that can be carried is 3 feet. The variations of water level between high and low water is 12 feet (exceptional floods not included).

The site for the lock near St. Martinville and the site for the dam across the head of Bayou Fusilier have been located, and the land required near the proposed lock has been surveyed. A deed of all the land required for lock and canal feeders has been tendered, and an abstract of title was forwarded to the Department April 27, 1908, for an opinion by the Attorney-General as to the validity of title.

Work was in progress during the year under a contract for dredging through the bars in Bayou Teche below New Iberia, La., and was completed February 21, 1908. The total distance dredged was 10,895 feet, to an average depth of 6 feet and a width of 30 feet at mean low tide.

Six wrecks were removed from the navigable channel of the bayou. For detailed statement regarding the progress of the work see report for Removing Sunken Vessels or Craft Obstructing or Endangering Navigation, page 431.

An allotment of $500 from the appropriation for emergencies in river and harbor works was made January 10, 1908, for expenditure in connection with the removal of logs from the navigable channel of Bayou Teche, Louisiana. Two informal offers for doing the work were received, the lower being accepted, and emergency contract prepared and sent for signature, but the bidder failed to execute and return it. This work is not of a very urgent character, and probably can best be done when the dam construction on this bayou provided for by the river and harbor act of March 2, 1907, is begun.

To June 30, 1908, $95,989.28 had been expended upon this work, of which $10,695.75 was for maintenance and $4,293.53 for expenses of resurvey of the bayou and $81,000 for works of improvement.

The maximum draft that could be carried June 30, 1908, was about 4 feet. The usual variation of level of water surface is not definitely known.

The bayou is navigable to St. Martinville, 75 miles from its mouth. The effect of the project on freight rates is not positively known.

It is proposed to apply the appropriation recommended to dredging shoals and removing obstructions in the channel as far up as the proposed site of the locks, 3½ miles below St. Martinville, La.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31, 1899	286,091	47,308	.....
Calendar year—			
1899	272,975	.....	13,116
1900	212,109	.....	60,866
1901	335,583	123,474	.....
1902	404,454	72,871	.....
1903	450,542	42,088	.....
1904	362,706	.....	87,836
1905	701,243	338,537	.....
1906	706,091	4,848	.....
1907	580,216	.....	125,875

July 1, 1907, balance unexpended	$133,127.08
Amount allotted from emergency appropriation act of March 2, 1907	500.00
	133,627.08
June 30, 1908, amount expended during fiscal year, for maintenance of improvement	3,116.36
July 1, 1908, balance unexpended	130,510.72
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	20,000.00

(See Appendix S 6.)

7. *Removing sunken vessels or craft obstructing or endangering navigation.*—Allotments aggregating $788.80 were made during the fiscal year and applied to payment of expenses incident to printing specifications and advertising for proposals for removing sunken logs and for payment of expenses of removing wrecks from the navigable channel of Bayou Teche, Louisiana. The proposed work was duly advertised and a contract was made for the removal of six wrecks obstructing the channel of the stream. The work was commenced February 24 and completed March 5, 1908, all of the wrecks having been removed except the old hull of boat near Franklin, La., which could not be located by the contractor. The total amount earned by the contractor was $650. The remainder of the amount allotted was expended for payment of expenses of advertising, printing specifications, and expenses of inspector engaged in connection with the removal of the wrecks.

(See Appendix S 7.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Report dated July 13, 1907, on preliminary examination of *Bayou Courtableau, Louisiana, with a view to obtaining 12 feet of water*, was submitted by the district officer and was reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law. The report was transmitted to Congress and printed in House Document No. 478, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government to the extent indicated.

The local officer was also charged with the duty of making a preliminary examination and survey of *Bayou Terrebonne, Louisiana*, provided for in the river and harbor act of March 2, 1907, and reports thereon will be duly submitted.

IMPROVEMENT OF RIVERS AND HARBORS IN THE SECOND NEW ORLEANS, LOUISIANA, DISTRICT.

This district was in the charge of Maj. James F. McIndoe, Corps of Engineers, to August 31, 1907, in the temporary charge of Col. E. H. Ruffner, Corps of Engineers, from August 31, to October 31, 1907, and in the charge of Major McIndoe since October 31, 1907, having under his immediate orders First Lieut. Wildurr Willing,

Corps of Engineers, since February 5, 1908. Division engineer, Col. E. H. Ruffner, Corps of Engineers.

1. Homochitto River, Mississippi.—About 8 miles above Fort Adams, Miss., the Homochitto enters the Mississippi River. For the first 3 miles from that point it is designated as the "Narrows," and for a distance of 12 miles farther as "Old River." A preliminary examination, made in 1896, showed that the Narrows had a depth of 5 feet at low water and a width of 150 feet, except for a distance of about 1 mile, where the stream is very narrow and shoal. This narrow and shoal portion was obstructed by snags and logs. Old River was about 1,000 feet wide and about 2 feet in depth over the shoalest places at low water. It was clear of obstructions. Above Old River the Homochitto River had a navigable depth of about 8 feet and a width of about 150 feet for a distance of about 45 miles, but it was thickly obstructed by snags, logs, and overhanging trees.

The act of March 3, 1899, appropriated $16,000 for the removal of obstructions between the mouth of the river and the Yazoo and Mississippi Valley Railway bridge, a distance of about 60 miles, and a project for the work was approved April 18, 1899.

Work under this project was commenced November 27, 1899, and continued until August 13, 1900, resulting in the improvement of the channel for a distance of about 18 miles and a width varying from 60 to 200 feet. Subsequent operations have been for maintenance.

The amount expended to June 30, 1908, is $17,686.90, of which $2,205.23 was applied to the maintenance of the improvement. The expenditures during the past fiscal year were for preparation of plans of boat, printing, and advertising.

The Homochitto River is navigable in fact during periods of high water in the Mississippi River for a distance of about 18 miles, above which point it would be navigable for a farther distance of about 42 miles except that it is thickly obstructed with snags, logs, and overhanging trees. The maximum draft that could be carried, June 30, 1908, over the bar at lower end of Old River, the shoalest part of the locality under improvement, was about 2½ feet at mean low water. The 5 miles of channel above Old River, which was cleared of obstructions in 1903, has again become badly obstructed by snags.

The usual variation in level of the water surface between high and low water is about 30 feet, the high-water period usually lasting about three and one-half months. No point on the river where the channel has been improved is reached by a railroad, and the project has therefore no effect on freight rates.

No detailed commercial statistics for the calendar year 1907 were available. Circular letters and blank forms for furnishing statistics were sent out, but no replies were received. The commerce consists mainly in the rafting of timber.

On page 393, Annual Report of the Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys,

Reference is invited to report on preliminary examination made in accordance with river and harbor act of March 2, 1907, printed in House Document No. 692, Sixtieth Congress, first session. For the reasons given therein, this river is considered not worthy of further

improvement by the United States at the present time, and in compliance with section 7, river and harbor act of March 3, 1899, discontinuance of appropriations is recommended.

July 1, 1907, balance unexpended	$6,332.19
June 30, 1908, amount expended during fiscal year for maintenance of improvement	19.09
July 1, 1908, balance unexpended	6,313.10

(See Appendix T 1.)

2. Bogue Chitto, Chefuncte River, Bogue Falia, Tickfaw River and tributaries, Amite River, and Bayou Manchac, Louisiana.—(*a*) *Bogue Chitto.*—Originally navigation on this stream was impeded by snags, logs, and overhanging trees throughout its entire length, except during very high stages of water. The minimum width of channel was 80 feet and the least depth of water 3 feet.

The present project, adopted in 1890, provided for securing and maintaining a channel 3 feet deep from the mouth of the river to Alford's bridge, near Summit, Miss., a distance of about 100 miles, by closing the west mouth and several small run-out bayous, and by the removal of obstructions and overhanging trees, at an estimated cost of $55,000.

Owing to the inadequacy of appropriations it has been possible to carry out the above project only as far as Cross River, about 80 miles, which distance had to be cleared periodically to maintain the improvement. On June 30, 1900, the condition of the river permitted of navigation being had by light-draft boats from the mouth of the river to Cross River. Subsequent operations have been for maintenance.

The amount expended to June 30, 1908, is $27,842.54, of which amount it is estimated $12,929.94 was applied to maintenance.

Bogue Chitto is navigable in fact for a distance of about 84 miles from its mouth. The only advantage derived from the expenditures for improvement of the stream was the facilitating of the rafting of logs and timber. The maximum draft that could be carried on June 30, 1906, was about 2½ feet. The usual variation in level of the water surface between high and low water is about 11 feet. The secretary of the railroad commission of Louisiana informs me that points on this stream have no reduction in freight rates on account of water competition.

The commerce consists mainly of the rafting of logs and timber for the surrounding sawmills. No boats ply regularly on this stream.

Bogue Chitto is not considered worthy of further improvement, the results accomplished by previous expenditures being sufficient for the needs of the commerce on the stream, and in compliance with section 7, river and harbor act of March 3, 1899, discontinuance of appropriations is recommended. There were no operations during the year.

On page 394, Annual Report of the Chief of Engineers for 1906, reference is made to reports on examinations and surveys of this stream.

Amount (estimated) required for completion of existing project ... $30,000.00

(*b*) *Chefuncte River and Bogue Falia.*—Prior to improvement of Chefuncte River, a bar, with a depth of only 4½ feet of water, obstructed the entrance to the mouth of the river. From this point to its junction with the Bogue Falia, a distance of 10 miles, the river was

from 300 to 800 feet in width, with a channel of 15 feet in depth, navigable for steamers and sailing vessels, but obstructed by snags and overhanging trees. Above this point the stream is not navigable.

Bogue Falia was navigable for small steamers from point of junction with the Chefuncte to Grants Landing, 4 miles above; for sailing vessels drawing 5 feet or less, to Covington, 2 miles farther; obstructed by snags and overhanging trees. Not navigable beyond Covington.

The original project of 1880 provided for dredging through the bar at the mouth of the Chefuncte River, and for the removal of all obstructions between its mouth and Covington on the Bogue Falia, at an estimated cost of $5,460. It was modified in 1884 to permit of the construction of a breakwater to protect the channel dredged across the bar at the mouth of the Chefuncte River. Estimated cost, $1,500.

For an account of the improvements under original project and modification, see Annual Report of the Chief of Engineers for 1896, page 1485. Subsequent operations have been for maintenance.

It is proposed to apply the available funds toward the construction of a combined dredge and snag boat and to the operation of said boat for the removal of bars and such snags, logs, and overhanging trees as interfere with navigation between Covington and the mouth of the river.

The amount expended to June 30, 1908, is $12,541.97, of which $6,041.97 was applied to maintenance. The expenditures during the past fiscal year were for commercial statistics, preparation of plans, and inspection of construction of boat, printing, and advertising.

On June 30, 1908, the maximum draft that could be carried over the bar at the mouth of the Chefuncte River was 7 feet, the expenditures for improvement having resulted in an increase of 2½ feet in depth and 60 feet in width. The head of navigation is Covington on the Bogue Falia, about 16 miles by river from Lake Pontchartrain. The upper part of the stream is so crooked that boats 200 feet long can run only 12½ miles up the river and boats 110 feet long only 15 miles. The variation in level of water surface between high and low tide is usually about 1 foot, although winds may make a variation of as much as 3 feet.

The only information obtained as to the effect of the project on freight rates is a statement from the secretary of the State railroad commission that Covington has reduced rates on account of the navigation on that river.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1897	110,034	42,354	.....
1898	99,505	.....	10,529
1899	97,789	.....	1,716
Calendar year—			
1899	156,500	58,711	.....
1900	86,856	.....	69,644
1901	92,874	6,018	.....
1902	100,768	7,894	.....
1904	184,099	83,331	.....
1905	222,494	38,395	.....
1906	235,727	13,233	.....
1907	221,177	.....	14,550

On page 395, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of these streams.

July 1, 1907, balance unexpended	$8,441.25
June 30, 1908, amount expended during fiscal year for maintenance of improvement	177.23
July 1, 1908, balance unexpended	8,264.02
July 1, 1908, amount covered by uncompleted contracts	5,000.00

(c) *Tickfaw River and tributaries, Louisiana.*—These streams—the Tickfaw, Blood, Natalbany, and Ponchatoula rivers—had a 9-foot channel, navigable for steamers and schooners for an aggregate distance of 38 miles, but obstructed by snags, logs, and overhanging trees.

The original project, adopted in 1881, provided for the removal of obstructions as far as appropriations would permit; estimated cost, $10,230. The existing project is for maintenance of improvement, and under these two projects the work has been carried on since 1881.

All obstructing deadheads were removed from the channel from the mouth of the Tickfaw River to Springfield on the Natalbany, and a channel was dredged across a point, which had been a serious obstruction to navigation, just above Springfield.

It is proposed to apply available funds toward the construction of a combined dredge and snag boat and to the operation of this boat for the removal of bars and such snags, logs, and overhanging trees as interfere with navigation.

The amount expended to June 30, 1908, is $14,157.46, of which it is estimated $6,157.46 was applied to maintenance. The expenditures during the past fiscal year were for collection of commercial statistics, preparation of plans and inspection of construction of boat, printing, and advertising.

On June 30, 1908, the maximum draft that could be carried over the bar at the mouth of the Tickfaw River at mean low water was 6 feet. There is at all times water enough in the river to accommodate a draft of 10 feet. The usual tidal variation of level of water surface is about 6 inches, but winds effect a variation of from 1 to 2 feet.

Tickfaw River is navigable in fact to Kemps Landing, about 18 miles from its mouth in Lake Maurepas; Blood River, to S. Tuckers Landing, about 4 miles; Natalbany River, to the parish bridge just above Springfield, La., about 12 miles; Ponchatoula River, to Wadesboro, La., about 5 miles. The expenditures for improvement have been confined to the removal of snags, logs, and other obstructions.

No point on any of these streams is reached by a railroad, and there is no competition in freight rates.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1897	58,115	.....	14,736
1898	75,579	17,764	.....
1899	52,961	.....	22,618
Calendar year—			
1899	79,300	26,339	.....
1900	55,540	.....	23,700
1901	56,464	924	.....
1902	45,632	.....	10,832
1904	86,302	40,670	.....
1905	45,429	.....	40,873
1906	34,690	.....	10,739
1907	44,350	9,660	.....

On page 397, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of these streams.

July 1, 1907, balance unexpended	$6,166.51
June 30, 1908, amount expended during fiscal year for maintenance of improvement	166.51
July 1, 1908, balance unexpended	6,000.00
July 1, 1908, amount covered by uncompleted contracts	5,000.00

(*d*) *Amite River and Bayou Manchac, Louisiana.*—Prior to improvement the Amite River was navigable for small steamers for a distance of 45 miles from its mouth and Bayou Manchac for a distance of 10 miles, but both streams were obstructed by snags, logs, and overhanging trees.

The original project, as adopted in 1880 and modified in 1883 and 1888, provided for the removal of obstructions in Bayou Manchac from Hope Villa to the Amite River, and in the latter stream to Lake Maurepas (its mouth), at an estimated cost of $31,760.

Amite River was improved for a distance of 42 miles from its mouth and Bayou Manchac for a distance of 10 miles from its junction with the former stream. A turning basin was made at the upper limit of improvement in Bayou Manchac.

The work of maintenance has been carried out under the project of 1892 and subsequent projects.

The improvement is not considered permanent, as snags and logs will continue to accumulate and bars will continue to form at the mouths of the streams, thus obstructing navigation.

It is proposed to apply the available funds toward the construction of a combined dredge and snag boat and to the operation of the boat for the removal of bars and such snags, logs, and overhanging trees as interfere with navigation.

The amount expended to June 30, 1908, is $42,282.68, of which it is estimated $17,381.96 was applied to maintenance. The expenditures during the past fiscal year were for collection of commercial statistics, preparation of plans and inspection of construction of boat, printing, and advertising.

On June 30, 1908, the maximum draft that could be carried at mean low water over the bar in Lake Maurepas at the mouth of the river was 6 feet. The usual tidal variation at mouth of river is 6

inches; the level of water surface in Bayou Manchac varies as much as 6 feet. Amite River is navigable in fact to the mouth of Bayou Manchac, a distance of 42 miles, and Bayou Manchac is navigable to Hope Villa, a distance of 10 miles.

The only information obtained as to the effect of the project on freight rates is a statement from the secretary of the State railroad commission that Hope Villa, on Bayou Manchac, has been granted a special tariff, with rates lower than normal ones.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1897	49,509	.....	5,594
1898	54,749	5,240	.....
1899	60,305	5,556	.....
Calendar year—			
1899	59,850	.....	455
1900	25,400	.....	34,450
1901	69,918	44,518	.....
1902	44,694	.....	25,224
1904	120,851	76,157	.....
1905	43,371	.....	77,480
1906	50,669	7,298	.....
1907	45,552	.....	5,117

On page 398, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of these streams.

July 1, 1907, balance unexpended	$20,377.02
June 30, 1908, amount expended during fiscal year for maintenance of improvement	165.69
July 1, 1908, balance unexpended	20,211.33
July 1, 1908, amount covered by uncompleted contracts	7,400.00

CONSOLIDATED.

July 1, 1907, balance unexpended	$34,984.78
June 30, 1908, amount expended during fiscal year for maintenance of improvement	509.43
July 1, 1908, balance unexpended	34,475.35
July 1, 1908, amount covered by uncompleted contracts	17,400.00
Amount (estimated) required for completion of existing project	[a]30,000.00

(See Appendix T 2.)

3. Bayou Plaquemine, Grand River, and Pigeon bayous, Louisiana.—[This work was in the charge of Col. E. H. Ruffner, Corps of Engineers, to February 29, 1908.] Prior to 1867 the largest steamboats could pass through Bayou Plaquemine into Grand Lake and other connecting water routes, but at that time the police jury of Iberville Parish closed the bayou by means of a dam, shutting out the waters of the Mississippi. Grand River and Pigeon bayous were obstructed by snags, logs, overhanging trees, and sand bars.

[a] Applies to Bogue Chitto only.

The present project is based upon legislation by Congress, according to project and estimate submitted February 11, 1887, and provides for dredging a channel in Bayou Plaquemine 60 feet wide and 6 feet deep from deep water up to the Plaquemine dike, constructing a lock to connect the bayou with the Mississippi River, securing the mouth of the bayou from further caving, and removing obstructions from Grand River and Pigeon bayous; total estimated cost, $1,708,250, subsequently increased to $1,740,000.

The project of 1887 was modified on April 10, 1899, to allow for dredging Bayou Plaquemine to a depth of 10 feet and a width of 125 feet.

The protection of the bank of the Mississippi River at the mouth of the bayou was added to the improvement in 1888, and in act of July 13, 1892, the improvement of Grand River and Pigeon bayous was also incorporated therein.

The act of June 3, 1896, authorized continuing contracts to be entered into to complete the project of improvement not to exceed $1,173,250, exclusive of the amounts therein and previously appropriated. Of this amount $1,160,000 was subsequently appropriated. By act of March 3, 1905, $35,000 was appropriated for maintenance of improvement, and contracts not to exceed $100,000, exclusive of the amounts theretofore appropriated, were authorized for completing improvement. The latter amount was appropriated by sundry civil act of June 30, 1906.

The river and harbor act of March 2, 1907, appropriated $100,000 "for construction of a dredge and maintenance."

Contract for the rectification of Bayou Plaquemine under the modified project of April 10, 1899, was entered into July 15, 1899. To June 30, 1906, 506,630 cubic yards of material had been removed in accordance with the terms of the contract. In addition, 16,500 cubic yards was removed under supplemental contract from a portion of the channel which had shoaled. A partial channel was dredged through portions of the bayou up to the dike at the bayou approach to the lock, and work was suspended on June 27, 1905, until the lock shall have been opened to navigation, when work will be resumed and the material deposited in the Mississippi River.

An allotment of $75,000 was made from the appropriation of 1888 for securing the bank of the Mississippi River at the head of the bayou. Five submerged spur dikes, placed at intervals of about 900 feet, with intervals protected by revetment, were completed in 1894. These dikes and revetments form a continuous protection 1,400 feet long below the site of the lock and 1,200 feet above, with an interval of 500 feet opposite the lock site left for excavating the necessary channel to the lock. On November 30, 1901, and January 29, 1902, two mattresses, 400 by 600 feet and 400 by 450 feet, respectively, were sunk in the river and heavily loaded with stone for protection of the banks near the proposed approach to the lock.

In 1891 a project for the construction of a lock was submitted, but the funds available were insufficient to warrant its commencement at that time. The Board of Engineer officers appointed to prepare plans and specifications estimated the cost of the lock at $700,000. Revised plans and specifications for the construction of the lock and approaches were approved October 27, 1897, and December 2, 1897, respectively, and a continuing contract for the work was entered into May 28, 1898. The work was commenced in August, 1898. Under

this contract the floor and walls of the lock were completed, and miter sills, inlet pipes, and snubbing hooks placed. By direction of the Chief of Engineers the contract was annulled upon payment of the retained percentages and other items, aggregating $24,236.41. Revised plans for construction of lock gates and of the approaches to the lock, including excavation and fill, were approved on June 11, 1903.

For the approach to the lock 1.25 acres of land on the north side and 0.31 acre on the south side were purchased August 24, 1900, for $7,500.

A protection levee was built, under contract, from the northeast corner of the lock to connect with the main levee system in front of the lock. The work was completed August 8, 1902.

The contract for the lock gates was completed May 5, 1906, the gates being accepted on that date.

The contract with the Otis Elevator Company, dated November 18, 1899, for furnishing and erecting operating machinery and power house was completed August 31, 1906. The total cost of the work under this contract was $114,000.

A contract was entered into February 13, 1905, for constructing protection levee and making a portion of the fill behind the lock walls. The work was commenced in March, 1905, and was completed January 28, 1907. The total quantity of material placed under this contract was 39,940 cubic yards, costing $23,564.60.

A contract was entered into June 6, 1905, for construction of the approach at the bayou end and part of the approach at the river end of the lock. Work under this contract was commenced on October 10, 1905, and was completed in February, 1908. Under this contract there was excavated and placed behind the lock walls 65,729 cubic yards of material; 2,131 35-foot piles and 1,690 50-foot piles were driven; 9,855 cubic yards of concrete was placed in approach walls; 11 snubbing posts were placed; the total contract cost was $120,485.35. The amount expended under this contract during the fiscal year was $34,153.76.

A contract was entered into August 7, 1906, for excavation and construction of river approach and back fill of lock. Work under this contract was commenced in September, 1906, and at the end of the fiscal year a total of 14,600 cubic yards of earth had been moved from the old levee and placed in the protection levee at river end; 33,688 cubic yards of earth had been excavated and placed behind the lock walls; 1,311 50-foot piles had been furnished and 1,100 driven; 2,643 cubic yards of concrete had been placed in approach walls. The total amount earned by the contractor was $58,954.40, of which $39,226.69 was expended during the fiscal year 1908.

For maintaining the dredged channel through Bayou Plaquemine and Grand River and for removing sediment from the lock chamber the construction of a dredge was authorized by river and harbor act of March 2, 1907. In the estimate for this work it was proposed to expend $60,000 for the dredge and to operate same for two years at $15,000 per year; contingencies, $10,000.

A board appointed in May, 1907, to examine and report concerning this improvement recommended that the back filling behind lock and wing walls should be completed as soon as possible; that while it was being placed the lock walls should be tied together with steel rods

and turnbuckles, and that as soon as the back filling was completed the lower lock gate should be calked and the lock filled with water and left so for at least a month, after which the lock should be emptied and the gates readjusted.

No proposals were received when bids for back filling were first opened, September 16, 1907. Placing of tie rods was completed in October.

The Board was reconvened and renewed its recommendations that the back filling be completed as soon as possible, and recommended that additional tie rods be placed in the vicinity of the quoins and gate recesses, also that a further appropriation of $50,000 be secured, if possible, for the completion of the lock and appurtenances.

On March 8, 1908, a supplemental contract was made with W. O. Burton & Co. for the back filling, which was commenced March 17 and completed April 28. A total of 24,203 cubic yards was placed, at a cost of $22,992.85.

On February 24, 1908, a contract was made with A. Baldwin & Co. for the extra tie-rods and turnbuckles, delivery to be completed March 17. The turnbuckles were not delivered until April 25, when the back filling was practically completed, and therefore the extra rods were not placed.

The calking of the lower gate was completed May 11, and pumping water into the lock commenced next day. It soon became apparent that the leakage under, around, and through the gate was so excessive that the dredge could not alone fill the lock, and two 18-inch siphons were installed. Later a cut was made in the levee and two 15-inch and one 18-inch pipe placed therein in order to allow direct flow of water from the Mississippi River into the forebay of the lock. On June 9 the depth of water in the lock was 43 feet, and this depth was maintained during the month for the water test recommended by the Board of Engineer officers.

There has been no appreciable spreading of the walls since May 12, 1908; there was a uniform subsidence of the walls of 0.0528 foot between May 16 and June 15, but no change since the last date.

The sum of $1,634,224.17 had been expended on this improvement to June 30, 1908, including $1,000 withdrawn by the Chief of Engineers June 20, 1901, for office expenses, and $38.70, Treasury settlement, April 13, 1908, to Illinois Central Railroad, and also including $32,318.15 expended in back filling and testing the lock in accordance with the recommendations of the Board of Engineers. Of the total amount, it is estimated $17,371.66 was applied to the maintenance of the improvement.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1898	76,626	19,571	.....
1899	89,301	12,675	.....
Calendar year—			
1899	111,750	22,449	.....
1900	88,543	.....	23,207
1901	283,000	194,457	.....
1902	292,000	9,000	.....
1903	302,500	10,500	.....
1904	318,000	15,500	.....
1905	706,000	388,000	.....
1906	572,000	.....	134,000
1907	534,744	.....	37,256

Reports on examinations or surveys of Bayou Plaquemine may be found in the Annual Reports of the Chief of Engineers for 1882, page 1416; 1884, page 1431; 1886, page 1405; 1887, page 1407.

July 1, 1907, balance unexpended		$371,948.19
Amount allotted June 29, 1907, from appropriation for operating and care of canals, act of July 5, 1884		15,000.00
		386,948.19
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$101,808.36	
For maintenance of improvement	9,325.30	
Treasury settlement	38.70	
		111,172.36
July 1, 1908, balance unexpended		275,775.83
July 1, 1908, outstanding liabilities		1,287.70
July 1, 1908, balance available		274,488.13
July 1, 1908, amount covered by uncompleted contracts		143,079.36
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.		50,000.00

(See Appendix T 3.)

4. Inland waterway from Franklin to Mermentau, Louisiana.—The project for this waterway was adopted by Congress March 2, 1907, and provides for a channel 5 feet deep and 40 feet bottom width, with appropriate side slopes. The proposed channel is to connect with the Bayou Teche near Franklin, La.; thence to Cote Blanche and Vermilion bays by a dredged canal and existing drainage canals or bayous; thence up Schooner Bayou; thence by a dredged canal to White Lake; across White Lake; thence by a dredged canal to Grand Lake and across this lake to Lake Misere, west of the Mermentau River, at an estimated cost of $289,292, with an estimated cost for maintenance of $20,000 per year.

The act of March 2, 1907, appropriated $89,292, and contracts were authorized to complete the project not to exceed $200,000, of which there remains to be appropriated $100,000.

Under the general project the right of way must be furnished without cost to the United States. Promises to donate the right of way have been secured from the owners of all lands lying along the route between Grand Lake and Vermilion Bay and from the owners of part of the lands between Vermilion Bay and Franklin.

A party was in the field making the survey of location from July 16 to November 11, 1907, when the work was discontinued until promises of the necessary right of way could be secured. The survey was resumed June 23, 1908. The proposed waterway passes through school lands and drainage lands, and it has been found necessary to have acts passed by the State legislature to authorize the donation of the right of way to the United States for the construction of the waterway.

The proposed waterway must cross the right of way of the Southern Pacific Railroad, and a bridge for the service of the railroad will be necessary near Franklin, La. The War Department has decided that the cost of this bridge must be borne by the United States.

The amount expended to June 30, 1908, is $6,914.92, for inspections of the various routes and for the survey and for maps.

The appropriation recommended for the fiscal year 1910 will be applied to completion of dredging, in accordance with the adopted project.

The report on the examination of the inland-waterway channel is printed in House Document No. 640, Fifty-ninth Congress, second session.

July 1, 1907, balance unexpended	$88,093.79
Amount appropriated by sundry civil act approved May 27, 1908	100,000.00
	188,093.79
June 30, 1908, amount expended during fiscal year for works of improvement	5,716.71
July 1, 1908, balance unexpended	182,377.08
Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix T 4.)

5. Channel, bay, and passes of Bayou Vermilion, and Mermentau River and tributaries, Louisiana.—(a) Channel, bay, and passes of Bayou Vermilion.—Prior to improvement the upper 12 miles of Bayou Vermilion was only 2 feet deep, and its lower portion, through the bay and passes, not less than 5½ feet deep, and had a width varying from 100 to 400 feet. The channel, however, was obstructed by snags, logs, and overhanging trees.

The original project, adopted in 1880, provided for the removal of snags and for dredging at an estimated cost of $9,900. A modified project, adopted in 1892, provided for securing a navigable depth of 5½ feet up to the railroad bridge near Lafayette, La., and for the erection of guide piling to mark the channel from the mouth of the bayou to Vermilion Bay, a distance of about 5 miles, at an estimated cost of $25,000. Project for maintenance was adopted in 1905.

The improvement is not considered permanent, as obstructions will continue to form and must be periodically removed.

It is proposed to apply the available funds toward the construction of a combined dredge and snag boat and to the operation of said boat for the removal of bars and such snags, logs, and overhanging trees as interfere with navigation.

Operations were carried on by the steamer *Hyacinth* between June 11 and 18, 1908, for the removal of snags and other obstructions below Abbeville, La.

The amount expended to June 30, 1908, is $36,070.44, of which amount $26,170.44 has been expended for maintenance. The expenditures during the past fiscal year were for collection of commercial statistics, for preparation of plans and inspection of construction of boat, for printing and advertising and for clearing the channel of obstructions.

On June 30, 1908, the maximum draft that could be carried over the bar at mouth of Bayou Vermilion was about 3 feet and in the upper part of the stream 2½ feet. The usual tidal variations at mouth

of bayou is about 1 foot and in upper part about 18 inches. The bayou is navigable to D. O. Broussard's landing, about 20 miles above Abbeville, La., or 46 miles from mouth, although it is obstructed by snags and logs.

The only information obtained as to the effect of the project on freight rates is a statement from the secretary of the State railroad commission that at Abbeville there are lower rates than to intermediate points, on account of its being located on navigable water.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1898	8,862	2,786	.....
1899	14,969	6,107	.....
Calendar year—			
1900	21,150	6,181	.....
1901	31,385	10,235	.....
1902	37,000	5,615	.....
1903	15,157	.....	21,843
1904	29,326	14,169	.....
1905	28,092	.....	1,234
1906	32,025	3,933	.....
1907	37,515	5,490	.....

On page 399, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of this stream. The act of March 2, 1907, calls for a preliminary examination to Lafayette with a view to obtaining 6 feet of water. Report thereon will be submitted for transmission to Congress at its next session.

July 1, 1907, balance unexpended	$7,082.12
June 30, 1908, amount expended during fiscal year for maintenance of improvement	52.56
July 1, 1908, balance unexpended	7,029.56
July 1, 1908, amount covered by uncompleted contracts	5,000.00

(*b*) *Mermentau River and tributaries, Louisiana.*—Prior to improvement these streams had depths varying from 7 to 30 feet. The channel through Grand Lake was 6 feet deep, and the depth at the mouth of the river was about 13 feet. The width varies from 70 feet, near Viterboville, to 350 feet at Lake Arthur. The channel was crooked and obstructed by snags and logs.

The original project of 1892 provided for the removal of obstructions in the upper river and the construction of brush dams in the lower river to remove existing mud flats. The estimated cost was $23,615.25.

With the appropriations of 1892, 1894, and 1896 operations were carried on from December, 1892, to December, 1899, and 38 miles of the channel, from the lower end of Lake Arthur downstream, was cleared of obstructions; two brush dams, 2,500 and 3,000 feet in length, respectively, were built in Mud Lake, and a channel 8 feet in depth and 50 feet in width was cut across the flats in Mud Lake and maintained as the exigencies of navigation required.

An examination made in July, 1906, showed that Bayou Nezpique, the principal tributary, was obstructed with snags and logs and that

dredging would probably be required for maintenance of the channel through Grand Lake and Lower Mud Lake. Operations were commenced in Bayou Nezpique with a hired plant on August 21, 1906, and were completed on October 6, 1906. All obstructing snags and logs were removed from the channel for a distance of 21 miles below Viterboville, La.

It is proposed to apply the available funds toward the construction of a combined dredge and snag boat and to the operation of this boat for the removal of such bars, snags, logs, and overhanging trees as interfere with navigation.

The amount expended to June 30, 1908, is $27,846.72, of which it is estimated that $11,130.24 was applied to maintenance. The expenditures during the past fiscal year were for collection of commercial statistics, preparation of plans and inspection of construction of boat, and printing and advertising.

On June 30, 1908, the maximum draft that could be carried over the flats in Lower Mud Lake, the shoalest place in the channel, was 4 feet at mean low water. The usual variation of the level of water surface in the lower reaches of the river is about 1½ feet, and the extreme variation is about 2½ feet. Mermentau River is navigable throughout its whole length to about 2 miles above Mermentau, a distance of about 70 miles; Bayou Nezpique, the principal tributary, is navigable to Viterboville, La., a distance of about 25 miles above the head of the Mermentau River; Bayou Plaquemine Brule and Bayou des Cannes are each navigable for distances of about 10 miles.

The only information obtained as to the effect of the project on freight rates is a statement from the secretary of the State railroad commission that at Mermentau there are lower rates than at intermediate points, on account of its being located on navigable water.

Comparative statement of shipments and receipts for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1898	18,650	6,440	.....
1899	22,236	3,586	.....
Calendar year—			
1900	27,084	.....	.....
1901	29,291	2,257	.....
1902	50,326	21,035	.....
1903	63,690	13,364	.....
1904	45,866	.....	17,824
1905	42,413	.....	3,453
1906	61,634	19,221	.....
1907	49,756	.....	11,878

On page 401, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of this stream.

July 1, 1907, balance unexpended	$18,180.78
June 30, 1908, amount expended during fiscal year for maintenance of improvement	112.25
July 1, 1908, balance unexpended	18,068.53
July 1, 1908, amount covered by uncompleted contracts	7,500.00

CONSOLIDATED.

July 1, 1907, balance unexpended	$25,262.90
June 30, 1908, amount expended during fiscal year for maintenance of improvement	164.81
July 1, 1908, balance unexpended	25,098.09
July 1, 1908, amount covered by uncompleted contracts	12,500.00

(See Appendix T 5.)

6. Mouth and passes of Calcasieu River, Louisiana.—Prior to improvement there existed a depth of 6½ feet over the outer bar at the entrance to Calcasieu Lake. The lake was 15 miles in length, with a depth of 6 feet. The depth of water over the inner bars was 3½ feet, and from the upper bar to Lake Charles, La., the river was not less than 8 feet deep.

Under the original project of 1872, with the modification of 1881, a channel 8 feet in depth, 70 feet wide, and 7,500 feet in length was cut through the inner bars during 1874, 1882, and 1883, but this channel having shoaled to 3½ feet it was redredged in 1886, under the project of that year, and a plank revetment to provide against refilling was commenced. The noncompletion of this revetment caused the refilling of the channel.

The project of 1892, under which the present work is carried on, provides for the redredging of a channel 8 feet in depth through the inner bars and revetting this channel; to construct parallel jetties of brush and stone at the entrance to the outer pass, and to dredge a channel between these jetties to a depth of 12 feet if necessary. The total estimated cost of the jetties was $600,000.

Under this project the revetment was completed in August, 1893. A channel 8 feet deep and 50 feet wide, connecting deep water in Calcasieu Pass and Lake, was dredged in 1894, 1895, and 1898. Construction of the east jetty was carried on in 1894, 1895, and 1896, and of the west jetty in 1897. In 1900 the foundation of the west jetty was extended 1,000 feet, making its total length 3,200 feet.

An examination of the channel made in May, 1905, developed that the channel, dredged to a depth of 8 feet in 1903 through the inner pass, had shoaled to less than 4 feet, and that the revetment placed for protection of this channel had almost entirely disappeared.

The channel through the outer pass between the jetties had a depth at low tide of about 10 feet, which is ample for the present needs of navigation, considering the condition of channel through the inner pass.

Under the project for expenditure of amount appropriated by act of March 3, 1905, a survey was made from the mouth of the river to the outer pass; the channel at the inner pass was redredged to a depth of 7 feet and width of 100 feet for a length of 24,000 feet; the channel at the mouth of the river was redredged to a depth of 7 feet and width of 100 feet for a length of 10,000 feet; the entire channel through the lake was marked by creosoted pile clusters, 54 in number, at intervals of 1,500 feet; and the revetment at lower end of lake (inner pass) was rebuilt for a length of 8,230 feet. Dredging and marking channel were completed, under contract, August 25, 1906, and repairs to revetment April 6, 1907.

Project for maintenance of the improvement was adopted in act of March 2, 1907.

season a new chemical compound was used, which gave excellent results at greatly diminished cost. In the season's work a total of 227,292 gallons of chemical compound was used, at a cost for chemicals of $1,098.66. At the price paid in previous seasons for chemical compound this quantity would have cost $6,818.76. There was therefore a saving of over $5,700, which will pay the operating expenses of the *Ramos* and of the hyacinth booms for a season. It is estimated that each gallon of chemical destroyed approximately 10 to 12 square yards of hyacinths.

The steamboat *Hyacinth* (except the hull, which was purchased) was built and equipped by hired labor at the engineer depot at New Orleans at a total cost of $8,900.

During the fiscal year 1907 spraying operations were carried on in the streams of the Plaquemine-Morgan City route, resulting in clearing the streams of all obstructing hyacinths. Cow Bayou, a tributary of the Sabine River, Texas, and Bayou des Allemands and contiguous streams, which were completely blocked by hyacinths, were cleared.

In October, November, and December, 1906, the *Ramos* sprayed in Calcasieu River, in English Bayou, a tributary of the Calcasieu, and in Bayou Vermilion, but the season was too far advanced for good results.

During the working season of 1906 265,409 gallons of chemical compound was sprayed, at a cost of $0.0051 per gallon raw. During the fiscal year ending June 30, 1908, operations were carried on in Bayou des Allemands, Bayou Barataria, Bayou Vermilion, and in the streams of the Plaquemine-Morgan City route.

During the working season of 1907 507,622 gallons of chemical compound was sprayed, at a cost of $0.0055 per gallon raw, and in 1908, to June 30, 124,236 gallons, at a cost of $0.0041 per gallon raw.

The amount expended to June 30, 1908, is $110,963.78. It is proposed to expend the available balance and the amount estimated as a profitable expenditure in continuing the work of destroying the water hyacinths which become obstructions to navigation and in repairs to the two steamboats used in this work, particularly the *Ramos*, which needs a new hull.

July 1, 1907, balance unexpended	$20,847.49
Received, sale of property	4.30
	20,851.79
June 30, 1908, amount expended during fiscal year for works of improvement	10,724.58
July 1, 1908, balance unexpended	10,127.21
July 1, 1908, outstanding liabilities	72.50
July 1, 1908, balance available	10,054.71
Amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	15,000.00

(See Appendix T 7.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys re[illegible] by the *river and harbor* act of March 2, [illegible] the follo[illegible]ities

7. Removing the water hyacinth from waters in Louisiana and Texas.—Under the provisions of the sundry civil act of June 4, 1897, a Board of Engineer officers, appointed to investigate the extent of obstruction to navigation in the streams of Florida and Louisiana and to determine a method of checking the growth of or removing the water hyacinth, recommended the construction of boats fitted with crushing machinery and the use of log booms as adjuncts to the boats. (See Annual Report of the Chief of Engineers for 1899, p. 1615.)

Under the act of March 3, 1899, $25,000 was appropriated for the purchase of a boat, $1,000 for the construction of log booms, and $10,000 for operating expenses.

A boat, purchased and fitted with machinery for crushing the hyacinths, was operated in Bayou Plaquemine and contiguous streams from July, 1900, to June, 1901, when funds were exhausted. Approximately 188,800 square yards of plants was removed.

A boom, with a suitable gate to permit of the plants floating out with the tides and to prevent their return, was constructed and placed at the mouth of Bayou Teche, Louisiana.

Act of June 13, 1902 permitted the destruction of the plants by chemical means or otherwise, and the boat was fitted with special machinery designed for spraying the plants with a chemical compound. Operations were carried on in this manner from September, 1902, to May, 1903, and from August to October, 1903. Approximately 522,750 gallons of the compound was sprayed over an area estimated at 3,509,024 square yards of hyacinths.

Bayou Plaquemine and contiguous streams were, at date of cessation of operations (October 26, 1903), practically free from hyacinths.

With funds allotted May 31, 1904, from appropriation of April 28, 1904, the steamboat *Ramos* began spraying operations in Bayou Plaquemine July 8, 1904. By October 31, 1904, when the season's operations were terminated, the following streams were effectively cleared of all obstructing hyacinths: Bayou Plaquemine, Grand River, Bay Natchez, Bayou Goddell, Belle River, Bayou Long, Bayou Grossetete, and Bayou Choctaw. Booms for controlling the hyacinths were placed in Bayou Plaquemine, at mouth of Bay Grossetete, at the head of navigation in Bayou Grossetete, and across Bayou Choctaw. During the summer months a watchman is maintained at the Bayou Plaquemine boom, whose duty it is to require all rafts and boats to clear themselves of hyacinths before passing through.

During the winter of 1904 the *Ramos* was extensively repaired and fitted with a pile driver and steam capstan.

The act of March 3, 1905, appropriated $40,000 for the removal of the water hyacinths from the navigable waters of the States of Texas and Louisiana, and projects, approved April 28 and May 15, 1905, provided for continuance of spraying operations in the Plaquemine-Morgan City water route and for the outfitting of a second boat for operations in the Calcasieu River, Louisiana, and in the Sabine and Neches rivers, Texas.

Operations were resumed in Bayou Plaquemine April 8, 1905, and were continued until October 31 in this and connecting streams named above, at which date the condition of the streams between Plaquemine and Morgan City was sufficiently satisfactory to warrant the suspension of further spraying operations for the season. During the entire

season a new chemical compound was used, which gave excellent results at greatly diminished cost. In the season's work a total of 227,292 gallons of chemical compound was used, at a cost for chemicals of $1,098.66. At the price paid in previous seasons for chemical compound this quantity would have cost $6,818.76. There was therefore a saving of over $5,700, which will pay the operating expenses of the *Ramos* and of the hyacinth booms for a season. It is estimated that each gallon of chemical destroyed approximately 10 to 12 square yards of hyacinths.

The steamboat *Hyacinth* (except the hull, which was purchased) was built and equipped by hired labor at the engineer depot at New Orleans at a total cost of $8,900.

During the fiscal year 1907 spraying operations were carried on in the streams of the Plaquemine-Morgan City route, resulting in clearing the streams of all obstructing hyacinths. Cow Bayou, a tributary of the Sabine River, Texas, and Bayou des Allemands and contiguous streams, which were completely blocked by hyacinths, were cleared.

In October, November, and December, 1906, the *Ramos* sprayed in Calcasieu River, in English Bayou, a tributary of the Calcasieu, and in Bayou Vermilion, but the season was too far advanced for good results.

During the working season of 1906 265,409 gallons of chemical compound was sprayed, at a cost of $0.0051 per gallon raw. During the fiscal year ending June 30, 1908, operations were carried on in Bayou des Allemands, Bayou Barataria, Bayou Vermilion, and in the streams of the Plaquemine-Morgan City route.

During the working season of 1907 507,622 gallons of chemical compound was sprayed, at a cost of $0.0055 per gallon raw, and in 1908, to June 30, 124,236 gallons, at a cost of $0.0041 per gallon raw.

The amount expended to June 30, 1908, is $110,963.78. It is proposed to expend the available balance and the amount estimated as a profitable expenditure in continuing the work of destroying the water hyacinths which become obstructions to navigation and in repairs to the two steamboats used in this work, particularly the *Ramos*, which needs a new hull.

July 1, 1907, balance unexpended	$20,847.49
Received, sale of property	4.30
	20,851.79
June 30, 1908, amount expended during fiscal year for works of improvement	10,724.58
July 1, 1908, balance unexpended	10,127.21
July 1, 1908, outstanding liabilities	72.50
July 1, 1908, balance available	10,054.71
Amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	15,000.00

(See Appendix T 7.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the *river and harbor* act of March 2, 1907, of the following localities

within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of Lake Pontchartrain, Louisiana, from West End to Bayou St. John, and thence to Milneburg.—Report dated December 19, 1907, is printed in House Document No. 557, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. Preliminary examination of Homochitto River, Mississippi, from its mouth to the Yazoo and Mississippi Valley Railroad.—Report dated January 17, 1908, is printed in House Document No. 692, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

3. Preliminary examination with plan and estimate of cost of improvement of Bayou Plaquemine Brule, Louisiana.—Reports dated December 19, 1907, and February 7, 1908, are printed in House Document No. 789, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $10,000 is submitted.

4. Preliminary examination with plan and estimate of cost of improvement of Lake Pontchartrain, Louisiana, from West End, Spanish Fort, and Milneburg to the north and south draws of the New Orleans and Northeastern Railroad; also to Mandeville, the Tangipahoa River, and Pass Manchac.—Reports dated December 20, 1907, and January 25, 1908, are printed in House Document No. 881, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $12,000 is submitted.

5. Preliminary examination with plan and estimate of cost of improvement of Pass Manchac, between Lake Maurepas and Lake Pontchartrain, Louisiana.—Reports dated December 19, 1907, and January 25, 1908, are printed in House Document No. 882, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $6,000 is presented.

The local officer was also charged with the duty of making a preliminary examination and survey of *Bayou Vermilion to Lafayette, La.*, provided for in the river and harbor act of March 2, 1907, and report thereon will be duly submitted when received.

IMPROVEMENT OF RIVERS AND HARBORS IN THE GALVESTON, TEXAS, DISTRICT.

This district was in the charge of Capt. John C. Oakes, Corps of Engineers. Division engineer, Col. E. H. Ruffner, Corps of Engineers.

1. Galveston Harbor, Texas.—Galveston Harbor originally embraced an anchorage area of over 1,960 acres, of which 1,500 acres had a depth of more than 20 feet, 1,300 acres had a depth of more than 24 feet, and 460 acres had a depth of more than 30 feet.

The entrance was obstructed by two bars, known as the inner and outer. The natural depth on the inner bar was about 9 feet and on the outer bar about 12 feet. These shallow depths prevented all but the lightest draft vessels from using the harbor, and necessitated the lighterage of cargoes to the larger vessels anchored in the deep water beyond the outer bar.

Prior to 1874 the projects for improving the habor related to dredging operations on a small scale.

The project for the permanent improvement by jetties was adopted in 1874 and modified in 1880 and 1886. Previous to 1886, $1,478,000 was expended, with an additional sum of $100,000 subscribed by the city of Galveston in 1883.

The 1886 project provided for a certain depth of 25 feet and a possible depth of 30 feet by constructing jetties to a height of 5 feet above mean low tide and extending them to the 30-foot contour in the Gulf and supplementing the action of the tidal scour by dredging. The estimated cost of this revised project was $7,000,000.

The expenditures under the above projects resulted in 1900 in a depth of 26 feet at mean low tide on the outer bar, an increase of 14 feet since work began, and a depth of 26 feet at mean low tide on the inner bar, an increase of 16 feet during the same period.

The south jetty extended 35,603 feet and the north jetty extended 25,907 feet. The amount expended on this project was $7,041,684.42, of which $97,687.85 was for maintenance of the improvement.

The hurricane of September 8, 1900, damaged the jetties to a considerable extent, and a Board of Engineer officers estimated the cost of repairing same at $1,500,000. (Annual Report Chief of Engineers, 1901, p. 2018.) Appropriations under this estimate commenced June 13, 1902, since which time $1,448,502.96 has been expended, of which $324,061.22 was for maintenance of the improvement.

The act of March 2, 1907, appropriated $300,000 and authorized continuing contracts for prosecuting the work to the amount of $700,000 additional, of which $70,000 remains to be appropriated. In pursuance of the discretion vested in him by this act, the Secretary of War approved a project for expenditure of the funds appropriated and pledged in obtaining a depth of 30 feet by repairing the jetties, by jetty extension, and by dredging, including construction of a new dredge.

For more extended information see House Document No. 340, Fifty-ninth Congress, second session, and River and Harbor Committee Document No. 11, Fifty-ninth Congress, second session.

The project for the expenditure of the above amounts includes the completion of the repairs to the jetties, the construction of a new seagoing dredge, operating dredges, and an extension of south jetty about 900 feet.

The project is about 25 per cent completed. Contract work on the new dredge is about 50 per cent completed. For details of dredge construction see Appendix H 9 of this report.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year ending June 30, 1910, to an extension of the jetties and operation of the dredges.

In addition to the amount required for maintenance, the estimate submitted for continuing the improvement is only the balance of the contract authorization of 1907, leaving it for Congress to decide from reports and estimates already before it to what extent it proposes to further prosecute the work of improvement at this locality.

Repairs to the jetties and the extension of south jetty were continued during the year under continuing contract and hired labor, in accordance with the act of 1907.

The U. S. dredge *Gen. C. B. Comstock* continued operations until October 19, 1907, working upon the outer bar when weather would

permit, and at other times on the inner bar. From October 19, 1907, to the end of the fiscal year the dredge was laid up awaiting the arrival of new boilers and undergoing extraordinary repairs.

The outer-bar channel, where dredging is done, weather permitting, had at the beginning of the fiscal year 28½ feet at mean low water. The last survey of June, 1908, shows a channel depth of 27½ feet, a shoaling of 1 foot during the past year. This is accounted for by the absence of the dredge from the outer bar during the past eight months.

The ruling depth varies from 27½ to 30 feet, according to the weather and length of time the dredge has been at work on the outer bar.

The inner bar has disappeared, leaving a ruling depth of 32¼ feet at mean low water. This result has been accomplished by the Galveston channel current, aided by the *Comstock*, which worked on the inner bar when it was too rough for it to work outside.

Mean tide fluctuations on outer bar, 2 feet; inner bar, 1.64 feet; Galveston channel, 1.12 feet. Including Galveston channel, 2,420 acres now have a depth of 24 feet and over, and 920 acres have a depth of 30 feet and over.

All the commerce for Galveston channel, Texas City channel, and Galveston ship channel and Buffalo Bayou which comes in from the Gulf or passes out to the Gulf, whether coastwise or foreign, passes through the jetty channel.

A Board of Engineer officers in its report of December 19, 1902, stated that a conservative estimate of the value to the country of the present improvement at Galveston is more than $10,000,000 per annum. This benefit is probably, at the present time, more than double that amount annually.

July 1, 1907, balance unexpended		$329,682.24
Amount appropriated by sundry civil act approved May 27, 1908		630,000.00
Proceeds of sales of charts of Galveston Bay		23.45
Proceeds of sales of contact prints		[a] 10.40
		959,716.09
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$177,841.03	
For construction of dredge	66,222.59	
For maintenance of improvement	63,057.31	
		307,120.93
July 1, 1908, balance unexpended		[b] 652,595.16
July 1, 1908, outstanding liabilities		[c] 127,034.68
July 1, 1908, balance available		525,560.48
July 1, 1908, amount covered by uncompleted contracts		[d] 487,405.91
Amount (estimated) required for completion of existing project		70,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908:		
For works of improvement	$70,000.00	
For maintenance of improvement	200,000.00	
		270,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix U 1.)

[a] Includes $10 received for blueprints of dredge.
[b] Includes $3,787.41 in hands of Major Deakyne for dredge construction.
[c] Includes $82,506.22 for construction of dredge.
[d] Includes $214,500 for construction of dredge.

2. Galveston channel, Texas.—This is the channel passing along the wharf front of the city and connecting the same with the jettied entrance channel.

Galveston channel inside the inner bar had originally a depth varying from 20 feet at Fort Point to 30 feet off Twentieth street, and again to 20 feet off Thirty-second street. The width of the channel between the 18-foot curves was about 600 feet. The inner bar had originally a 9-foot depth, but conditions gradually became better until the outer bar, with about 12-foot depth, became the controlling factor. All vessels drawing over 12 feet had to complete their cargoes after crossing the bar by lightering.

Appropriations by the United States Government for the channel began in 1902, when $100,000 was appropriated for improving the channel in accordance with the report submitted in House Document No. 264, Fifty-sixth Congress, second session. The act of March 3, 1905, authorized the construction of a dredge, *Col. A. M. Miller*, at a cost not to exceed $125,000.

The act of March 2, 1907, modified the project by providing for the extension of the channel from Fifty-first to Fifty-sixth street, at an estimated cost of $129,310. (See House Document No. 768, Fifty-ninth Congress, second session.)

The estimated cost of the project as modified is $1,714,310.

The U. S. dredges *Col. A. M. Miller* and *Gen. H. M. Robert* removed during the fiscal year 1,632,387 cubic yards of material in widening the channel and excavating an approach to the proposed United States immigrant landing station, which is to be located on the north side of the channel behind the dike. No maintenance work has been done during the year.

The project is about one-half completed, giving a channel approximately 700 feet wide and 28 to 30 feet deep, to the end of the present wharf frontage, and approximately 1,325 feet wide opposite the proposed immigrant landing station.

Total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1908, in dredging and dike construction, $684,631.27, of which $48,625.75 was for maintenance of the improvement.

Vessels drawing 27 feet can now come over the bar and up to the wharves at mean low water.

The *Missouri* left this port January 6, 1906, drawing 28 feet and 2 inches, and on November 15, 1907, the *Iowa* departed drawing 28 feet.

Variation of level of water surface is about 1 foot.

The foreign trade, as given by the customs office, for the Port of Galveston for the fiscal year 1907, amounted as follows: Foreign exports, valued at $236,277,727; foreign imports, valued at $7,621,761; total, $243,909,488.

Partial statistics for coastwise trade were furnished by the secretary of the Galveston Chamber of Commerce as 834,402 tons, valued at $203,768,556.

The following is a comparison of foreign export values credited to ports in the United States on the Gulf of Mexico in the Government records for a period of five years:[a]

[a] Data furnished by Judge A. J. Rosenthal, Special Deputy Collector, United States Customs Service.

Fiscal year.	Galveston.	New Orleans.	Mobile.	Pensacola.
1902-3	$103,145,623	$147,056,230	$12,618,443	$13,744,544
1903-4	144,920,127	148,006,606	16,826,671	15,891,834
1904-5	126,085,590	149,866,358	18,071,982	15,340,265
1905-6	166,240,813	149,901,013	21,712,544	18,440,122
1906-7	236,277,727	169,897,311	24,463,696	19,218,433

The value of foreign exports credited to the port of Galveston for the fiscal year 1896–97 amounted to $59,334,343, and for the fiscal year 1906–7 to $236,277,727, or about four times the amount for 1896–97. The gain from 1902–3 to the end of 1906–7 amounted to 129 per cent, the record for 1906–7 showing an increase of 43 per cent as compared with the year 1905–6.

A sufficient depth and width of channel is a necessary supplement to the deep water between the jetties to enable the vessels to reach the wharves. The work of the past year has put the channel in better condition for service than ever before, but with the increasing length of the vessels now entering the harbor, the necessity for the full width of channel between harbor lines (1,400 feet) is becoming very marked.

It is proposed to apply the balance available on June 30, 1908, to the extension of channel and dike to opposite Fifty-sixth street, and the additional appropriation recommended in operation of the United States dredge for widening the present channel and for maintenance.

July 1, 1907, balance unexpended	[a] $195,499.89
Proceeds of sales of contact prints	.15
	195,500.04
June 30, 1908, amount expended during fiscal year for works of improvement	134,956.15
July 1, 1908, balance unexpended	60,543.89
July 1, 1908, outstanding liabilities	4,351.52
July 1, 1908, balance available	56,192.37
Amount (estimated) required for completion of existing project	1,017,935.75
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	200,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix U 2.)

3. Channel from Galveston Harbor to Texas City, Tex.—The natural depth over the line of this channel was from 4 to 8 feet. During 1895 and 1896 a channel 16 feet deep was dredged by the Texas City Terminal Company at an expense of $116,000. At the time of the adoption of the present project this channel had shoaled to its natural depth.

[a] The balance unexpended July 1, 1907, $195,521.77, as shown by report for fiscal year ending June 30, 1907, is in error, the discrepancy being due to error in taking up $21.88 received from proceeds of sales of condemned property which did not pertain to this work.

The river and harbor act of March 3, 1899, provided for deepening the channel north of Pelican Island from Galveston Harbor to Texas City, Tex., to a depth of 25 feet and a width of 100 feet at the bottom, at a cost not to exceed $250,000.

The full amount had been expended on the work under this appropriation up to the close of the fiscal year ending June 30, 1905, the Texas City Company paying the expenses of superintendence, inspection, etc. The channel was dredged 100 feet wide on bottom and 25 feet deep from Texas City wharves to 25 feet of water in Galveston Harbor, a distance of 34,000 feet.

In addition to the amounts mentioned above, the Texas City Company, according to figures furnished by them, expended $148,906.98 in completing channel, $172,734.58 in digging turning basin and slip, and in 1906 removed 698,222 cubic yards at a cost of $16,028.61 in maintaining channel.

The further work contemplated is for maintenance of the channel. During the past fiscal year 1,001,147 cubic yards of material has been removed by contract at a cost of $30,606.60, for redredging the channel to a depth of 23 feet, with $875.73 expended during the year for surveys, superintendence, etc.

The total amount expended by the United States to June 30, 1908, is $275,519.69, of which $25,519.69 was applied to maintenance. In addition $4,686,01 was expended from deposit of contractors to cover expenses of superintendence, inspection, etc.

The maximum draft that can be carried June 30, 1908, at mean low tide over the shoalest part of this channel is 16½ feet.

Variation of water surface is about 1¼ feet.

The effect of the project on freight rates is not known.

The tonnage for the port of Texas City, Tex., for the calendar year 1907, as furnished by the Texas City Terminal Company, of Texas City, is as follows: Foreign exports and imports, 58,240 tons, valued at $4,466,173; coastwise domestic, 19,219 tons, valued at $2,401,600; total 77,459 tons, valued at $6,867,773.

Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 474 of this report.

It is proposed to expend the available balance and the appropriation recommended in maintaining the present channel.

July 1, 1907, balance unexpended	$59,841.32
Sales of contact prints	.20
	59,841.52
June 30, 1908, amount expended during fiscal year for maintenance of improvement	25,361.01
July 1, 1908, balance unexpended	34,480.51
July 1, 1908, outstanding liabilities	6,121.32
July 1, 1908, balance available	28,359.19
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	50,000.00

(See Appendix U 3.)

4. Channel to Port Bolivar, Tex.—The river and harbor act of March 2, 1907, appropriated $50,000 for obtaining a channel 150 feet wide and 25 feet deep, with increased width at wharf, from Galveston Harbor to Port Bolivar.

This channel will extend from the Gulf and Interstate Railway transfer wharf southerly to Bolivar Roads, a distance of 4,275 feet.

During the fiscal year a contract was entered into for dredging of channel, and 247,998 cubic yards of material was removed. Work was suspended December 9, 1907, pending the completion of bulkhead by the Gulf and Interstate Railway Company, behind which the spoil is to be placed.

The minimum depth over the line of proposed channel is 8 feet at mean low water.

Variation of water surface is about 1¼ feet.

The channel is used for tugs and barges in the transfer of freight cars to and from Galveston, and when completed will allow ships to load at the Bolivar wharf without transfer of freight to Galveston.

Amount expended on existing project to close of fiscal year ending June 30, 1908, $18,873.51.

The project is about 35 per cent completed.

No commercial statistics have been obtained.

Report on examination is printed in House Document No. 719, Fifty-ninth Congress, first session.

The available balance and the appropriation recommended will be applied toward completing the channel and in maintaining and widening the channel in front of the wharves to provide room for vessels to turn in.

July 1, 1907, balance unexpended	$49,834.42
June 30, 1908, amount expended during fiscal year, for works of improvement	18,707.93
July 1, 1908, balance unexpended	31,126.49
July 1, 1908, outstanding liabilities	4,455.35
July 1, 1908, balance available	26,671.14
July 1, 1908, amount covered by uncompleted contracts	20,011.36
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix U 4.)

5. Galveston ship channel and Buffalo Bayou, Texas.—The ship channel in Galveston Bay and Buffalo Bayou are two links in the waterway connecting Houston with deep water in Galveston Bay, the other links being the San Jacinto River and the Morgan Canal.

In their natural state these two waterways had a depth of from 4 to 8½ feet, of various widths. The earlier projects for their improvement, adopted in 1871, 1877, 1881, and 1892, provided for a channel 100 feet wide and 12 feet deep. Dredging was carried on for a number of years, furnishing a channel sufficient for the character of vessels then navigating these channels.

In 1892 the Government purchased the Morgan Cut and Canal 5.43 miles long, for $92,316.85.

The amount expended on original projects prior to operations under existing projects was as follows:

Ship channel in Galveston Bay (including the purchase of Morgan Cut and Canal, $92,316.85)	$800,328.16
Buffalo Bayou, Texas	210,137.64
Total	1,010,465.80

The existing project, adopted in 1899 (p. 1515, Annual Report Chief of Engineers, 1898), as modified in 1905 (p. 1495, et seq., Annual Report Chief of Engineers, 1905), is as follows:

For completing channel to head of Long reach, including turning basin 600 feet in diameter, 25 feet deep, side slopes 1 on 2, division 1 (bay), 1 on 3 in divisions 2 and 3 (river), least radius 2,500 feet, 150 feet on bottom in division 1 (bay), 100 feet on bottom in divisions 2 and 3 (river)	$3,170,000
26,000 feet of dike revetment	40,000
One hydraulic dredge	150,000
Engineering and contingencies (about 10 per cent)	340,000
Total	3,700,000
Amount available December 1, 1904	150,000
Balance required	3,550,000

The act of March 2, 1907, appropriated $200,000 and authorized continuing contracts for prosecuting the improvement in the sum of $200,000, of which $55,000 is yet to be appropriated.

Of the $200,000 appropriated March 2, 1907, $50,000 was expended for the restoration of the channel from foot of Main street, Houston, to head of Long reach.

By contract and United States dredges 1,978,241 cubic yards of material has been removed from the different divisions, of which 1,402,228 cubic yards was for maintenance and 28,000 cubic yards was rehandled, being material from the Houston division dredged with dipper, and dumped in turning basin to be pumped ashore. Snagging operations have been carried on in the upper stretches of the bayou.

During the fiscal year the channel has filled in generally throughout its entire length to an amount of 185,000 cubic yards, and since the beginning of 1905 a fill of 6,366,000 cubic yards has taken place.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1908, was $1,851,956.51, of which $152,284.65 was for maintenance.

The project is about 46 per cent completed.

The usual variation of level of water surface is, division 1 (bay division), lower bay, 1.3 feet; upper bay, 0.5 foot, and divisions 2 and 3 (river divisions), less than one-half foot. In times of flood rises of 12 or more feet occasionally occur in Buffalo Bayou.

The maximum draft that can be carried on June 30, 1908, at mean low tide is, from Bolivar channel to Red Fish, 16 feet; thence to Morgan Point, 11 feet; thence to Clinton, 16 feet; thence to head of Long reach, 12 feet; thence 8 feet to foot of Main street, Houston.

The effect of this project on freight rates is unknown and is indeterminate because of a railroad rate differential in favor of Houston, authorized by the railroad commission of the State of Texas.

The secretary of the Houston Cotton Exchange and Board of Trade reports the tonnage carried on the bayou during the calendar year 1907 as 452,463, valued at $24,466,730. It is given in detail in Appendix U 5 of this report.

For number of vessels passing through Morgan Canal, see report on operating and care of Morgan Canal, Appendix U 7 of this report.

It is proposed to expend the available funds and the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, toward completing work now under way, including dredging turning basin at head of Long reach, easing bends to 2,500 feet radius, maintenance toward a more uniform depth, repair of pile and brush dike in upper bay, and snagging operations throughout bayou.

If progress is to be made toward the completion of the project depth, 25 feet, throughout this channel, more liberal appropriations must be made for the work, as the cost of maintenance is increasing yearly as increased depth is obtained.

Except one stretch of 1¼ miles, this channel has been dredged to 18½ feet. By January 1, 1909, the remaining section will probably have been completed to that depth, but in the meantime some other section will have shoaled.

July 1, 1907, balance unexpended		$307,806.41
Amount appropriated by sundry civil act approved May 27, 1908		145,000.00
Proceeds of sales of contact prints		4.07
		452,810.48
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$138,529.28	
For maintenance of improvement	53,883.05	
		192,412.33
July 1, 1908, balance unexpended		260,398.15
July 1, 1908, outstanding liabilities		45,852.20
July 1, 1908, balance available		214,545.95
July 1, 1908, amount covered by uncompleted contracts		15,103.16
Amount (estimated) required for completion of existing project		2,855,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[a] 480,000.00

(See Appendix U 5.)

6. Removing the water hyacinths from Texas waters.—On August 9, 1907, water hyacinths were discovered in Buffalo Bayou, Texas, and vicinity, and an allotment of $500 was made on November 4, 1907, to destroy them and prevent them from becoming an obstruction to navigation.

During the fiscal year, under United States supervision, the city of Houston, Tex., removed practically all hyacinths from Buffalo Bayou by hired labor.

Total amount expended on this work up to the close of the fiscal year ending June 30, 1908, was $25.27.

[a] Of this amount $55,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907.

November 4, 1907, amount allotted	$500.00
June 30, 1908, amount expended during fiscal year for works of improvement	25.27
July 1, 1908, balance unexpended	474.73
July 1, 1908, outstanding liabilities	9.99
July 1, 1908, balance available	464.74

(See Appendix U 6.)

7. *Operating and care of Morgan Canal, Texas.*—A custodian was stationed at the canal during the past fiscal year.

A statement contained in the report of the local engineer officer shows the items of expenditure, which amounted to $360, exclusive of liabilities outstanding, amounting to $30.

(See Appendix U 7.)

8. *West Galveston Bay channel, Texas, and mouths of adjacent streams, including Trinity River, Anahuac Channel, Cedar Bayou, Chocolate Bayou, and Bastrop Bayou.*—This project embraced the improvement of the following localities: West Galveston Bay, the Galveston and Brazos Canal, Double Bayou, mouth of Trinity River, Anahuac Channel, East Bay Bayou, Turtle Bayou, Clear Creek, Dickinson Bayou, Chocolate Bayou, Bastrop Bayou, Oyster Creek, and the mouths of adjacent streams. (Annual Report Chief of Engineers, 1900, p. 2438, et seq.)

Prior to March 3, 1899, the improvement of West Galveston Bay channel, mouth of Trinity River, and Cedar Bayou had been independent. At that date they were consolidated with the other works, except Anahuac channel, which was added by act of March 3, 1905, and Chocolate and Bastrop bayous, which were added by the act of March 2, 1907. The Brazos River, between Velasco and Richmond, which was included in the improvement for a time, is now covered by a separate appropriation and has been transferred to the Dallas district. The estimated cost of the modified project is $248,646.34.

The object of this improvement, in part, is to obtain and maintain a navigable channel depth of from 4 to 6 feet across the bars at the mouths of the streams and bayous from deep water in the bay to deep water in the bayous.

The improvement is intended to develop a light-draft inland navigation which will afford cheap transportation by light-draft steamers and barges to the coast country of Texas.

As the West Galveston Bay channel and Galveston and Brazos River Canal have been included in the "Inland Waterway on the Coast of Texas" and appropriated for under that heading, allotments for these works under this appropriation have ceased.

About four-fifths of the project has been completed.

The effect of these improvements has been generally to decrease freight rates to all points reached by the channels improved.

It is proposed to apply the balance available and the appropriation recommended in dredging and snagging, for maintenance, and in opening up bayous emptying into the Galveston bays, in accordance with approved project.

More and larger boats, especially power boats with schooner hulls, have been built to utilize the improvement. Most of the points

reached are settlements not on railroads, and the improvements are of great importance to their commercial life.

The amount expended on these improvements under present project to June 30, 1908, has been as follows:

Channel across Hanna reef	$681.91
Double Bayou	10,549.15
Anahuac channel	12,100.00
Mouth of Trinity River	8,636.18
Cedar Bayou	11,885.52
Clear Creek	10,490.16
Dickinson Bayou	6,282.33
Bastrop Bayou	9,920.22
Chocolate Bayou	331.05
Dredge *Gen. H. M. Robert*	67,992.51
Total	138,869.03

CONSOLIDATED.

July 1, 1907, balance unexpended		$47,032.74
Taken up under improving inland waterway on coast of Texas		81.90
		46,950.84
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$15,515.39	
For maintenance of improvement	23,485.17	
		39,000.56
July 1, 1908, balance unexpended		7,950.28
Amount (estimated) required for completion of existing project		59,646.34
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		100,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*a*) *Channel across Hanna reef* (*East Bay Bayou*).—This is a channel across Hanna reef, connecting lower Galveston Bay, East Bay, and East Bay Bayou, and is on the direct line of the inland waterway project. The natural depth was 3.5 feet at mean low tide.

Amount expended to June 30, 1908, $681.91. This expenditure was made in 1903 and resulted in a channel 7 feet deep at mean low tide and from 40 to 60 feet wide. This channel has since closed and the maximum draft that can be carried, June 30, 1908, is about 2½ feet at mean low tide.

Variation of water surface about 1 foot.

It is estimated that 500 tons of vegetables comes out of East Bay Bayou each year and that about one-half as much returns. There is also some fish and oysters carried through this channel, but the present shallow channel prevents any extensive business being carried on.

(*b*) *Double Bayou.*—The navigation of this bayou was obstructed by a bar which prevented boats drawing over 2 feet of water entering the bayou.

The amount expended on work of existing project up to the close of the fiscal year ending June 30, 1908, $10,549.15, of which $3,595.95 was applied to maintenance, exclusive of $2,711.40 deposited by private parties.

This expenditure resulted in the excavation and maintenance of a channel 6,095 feet long, 80 to 100 feet wide, and from 5¾ to 7½ feet deep across the bar and into the bayou.

The maximum draft that can be carried June 30, 1908, at mean low water is 4½ feet.

The variation of water surface is about one-half foot. The bayou is navigable for 6 miles above the mouth.

The commerce through this channel, as given by Burt H. Collins, for the calendar year 1907, amounted to more than 3,600 tons of produce, mainly rice and merchandise, valued at $255,000.

July 1, 1907, balance unexpended	$3,999.45
Transferred to Clear Creek, Texas	403.50
	3,595.95
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,595.95

(*c*) *Anahuac channel.*—The original depth of this channel was about 3 feet.

Amount expended on work of existing project up to the close of the fiscal year ending June 30, 1908, $12,100, of which $6,124.99 was for maintenance of channel.

The expenditure resulted in the excavation and maintenance of a channel 16,013 feet long, 80 feet wide, and 7 feet deep, from 6 feet of water in Trinity Bay to 8 feet of water in Browns Pass; many large snags were removed from Browns Pass and Anahuac channel, and an old bulkhead was removed from the channel.

During the fiscal year 162,028 cubic yards of material was redredged in maintaining channel.

Maximum draft that can be carried June 30, 1908, at mean low tide is 7½ feet.

Variation of water surface is about one-half foot.

This channel is used by United States mail boat, and as there is no railroad communication with the adjacent country, all produce and supplies pass through this channel. Rice is the principal agricultural product.

Commercial statistics received show the commerce to be more than 74,311 tons, valued at $1,925,857.

July 1, 1907, balance unexpended	$6,124.99
June 30, 1908, amount expended during fiscal year for maintenance of improvement	6,124.99

(*d*) *Mouth of Trinity River.*—This river empties into Galveston Bay through several mouths or passes, opposite each of which a bar existed on which the depth of water did not exceed 3¼ feet at mean low tide.

Under earlier projects, adopted June 18, 1878, and amended May 4, 1899, dredging and snagging were done, the west jetty at Middle Pass completed to a length of 7,359 feet, and a channel 100 feet wide by 5 feet deep secured at a cost of $75,900. The channel subsequently shoaled to a ruling depth of 3½ feet, and at present Browns Pass leading into the Anahuac channel is the one used and under improvement.

Amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1908, $8,636.18, of which $4,995.74 was applied to maintenance.

Under present project a channel 80 feet wide and 6 feet deep was dredged a distance of 5,700 feet and a log jam removed from the pass.

During the fiscal year 23,959 cubic yards of material was removed for maintenance of channel.

Maximum draft that can be carried June 30, 1908, at mean low water, 7 feet.

Variation of water surface is about one-half foot.

During the calendar year 1907, lumber, rice, etc., valued at $1,003,609, and fuel oil, valued at $33,734, passed through this channel, in addition to miscellaneous supplies.

July 1, 1907, balance unexpended	$1,197.05
Transferred to Clear Creek, Texas	341.97
	855.08
June 30, 1908, amount expended during fiscal year for maintenance of improvement	855.08

(*e*) *Cedar Bayou.*—Cedar Bayou discharges into the northwest corner of Galveston upper bay, at a point about 1½ miles below the mouth of the San Jacinto River, and distant 28½ miles from Galveston.

The original project for this improvement was adopted September 19, 1890, and consisted in deepening the channel over the bar by dredging, so as to afford a depth of 5 feet at mean low tide, and protecting the dredged channel by brush and stone walls or jetties. The amount previously expended on this project was $32,150.

After crossing the bar a least depth of 9 feet can be carried up the bayou for a distance of 17 miles.

Under present project the jetties were repaired by filling the lowest places and gaps with riprap, and a channel 8 feet deep, 80 feet wide, 8,690 feet long was dredged from the 8-foot depth inside the bayou across Cloppers bar and connecting with the 8-foot depth in San Jacinto Bay.

During the fiscal year 100,709 cubic yards of material was removed in maintaining channel.

Amount expended on existing project to close of fiscal year ending June 30, 1908, $11,885.52, of which $4,939.37 was applied to maintenance.

Maximum draft that can be carried June 30, 1908, 6 feet.

The rise and fall of tide is about ½ foot, except during freshets.

It has been impossible to obtain the commercial statistics of the effect of this improvement. One boatman reports taking out 1,200,000 brick during the calendar year 1907, valued at $9,600. Rice and other agricultural products, together with supplies for the adjacent community, are carried through this channel, there being no railroad facilities within convenient distance.

July 1, 1907, balance unexpended	$5,153.85
Transferred to Clear Creek, Texas	214.48
	4,939.37
June 30, 1908, amount expended during fiscal year for maintenance of improvement	4,939.37

(*f*) *Clear Creek.*—Clear Creek empties into Galveston upper bay from the west. It was obstructed at its mouth by a narrow sand bar,

on which the depth did not exceed 2 feet. For a distance of 2 miles above the mouth the ruling depth is 8 feet; it then broadens into a lake 3 miles long and 1½ miles wide, having before improvement an average depth of 1½ feet. Above the lake the prevailing depth is from 8 to 12 feet, which can be carried 25 miles above its mouth.

Private parties have at various times dredged through the bar at the mouth into Galveston Bay, and at present there is across this bar a channel about 40 feet wide with a least depth of 6 feet at mean low tide.

During the past year the U. S. dredge *Captain C. W. Howell* has dredged a channel 22,847 feet long, 40 feet wide, and from 4 to 6 feet deep through the lake, making a continuous channel with a least depth of 4 feet at mean low tide for 25 miles.

Amount expended on existing project to close of fiscal year ending June 30, 1908, $10,490.16.

The maximum draft that can be carried June 30, 1908, at mean low tide over the shoalest part of the locality is 4 feet. Variation of water surface is three-fourths foot.

No commercial statistics have been obtained.

July 1, 1907, balance unexpended	$7,999.70
Transferred from other works	2,539.73
	10,539.43
June 30, 1908, amount expended during fiscal year for works of improvement	10,487.56
July 1, 1908, balance unexpended	51.87

(*g*) *Dickinson Bayou.*—Dickinson Bayou empties into Galveston lower bay, about 20 miles northwest of the city of Galveston. Navigation was obstructed by a bar at its mouth with 2½ feet of water on its crest. After crossing the bar a depth of 10 feet can be carried up the bayou for 20 miles or more, and a depth of 6 feet for a distance of 25 miles from its mouth.

During the past year the U. S. dredge *Captain C. W. Howell* excavated a channel 10,625 feet long, 40 feet wide, and 5 feet deep over a distance of 15,500 feet through the bar at the mouth and to deep water in the bayou.

Amount expended on existing project to close of fiscal year ending June 30, 1908, $6,282.33.

The maximum draft that can be carried June 30, 1908, at mean low tide over the bar is 3½ feet.

Variation of water surface is 1 foot.

No commercial statistics have been obtained.

July 1, 1907, balance unexpended	$6,999.70
June 30, 1908, amount expended during fiscal year for works of improvement	6,282.03
July 1, 1908, balance unexpended	717.67

(*h*) *Bastrop Bayou.*—Bastrop Bayou empties into Bastrop Bay, which is part of West Galveston Bay. The mouth of the bayou is 5 miles northwest of San Luis Pass and had a long shallow approach with only 10 inches of water on the bar. For 2 miles above the bar the water is shallow, averaging about 2 feet. Above that point there is, in general, a depth of 10 feet, but this depth was reduced by three

shoals of a total length of about 3 miles with a depth of 2 feet. The stream can be navigated above these shoals for a distance of 20 miles by vessels of light draft.

A channel 400 feet long, 35 to 40 feet wide, and 4 feet deep was cut through the shell reef at the entrance to Bastrop Bay by the U. S. dredge and snag boat *Gen. S. M. Mansfield* in 1906 at a cost of $269.42, this amount being subscribed by interested parties.

During the past year the U. S. dredge *Captain C. W. Howell* dredged a channel 18,765 feet long, 40 feet wide, and 4 to 5 feet deep from the shell reef at the entrance to Bastrop Bay, across Bastrop Bay, and up the bayou to the 5-foot depth of water above the three shoals obstructing navigation.

Amount expended on work of existing project to close of fiscal year ending June 30, 1908, $9,920.22.

The maximum draft that can be carried June 30, 1908, at mean low tide is 3 feet from bay to dredge.

Variation of water surface, 1 foot.

No commercial statistics have been obtained.

July 1, 1907, balance unexpended	$6,464.86
Transferred to Clear Creek, Texas	79.78
	6,385.08
June 30, 1908, amount expended during fiscal year for works of improvement	6,385.08

(*i*) *Chocolate Bayou.*—Chocolate Bayou empties into Chocolate Bay, an arm of West Galveston Bay, about 12 miles north of San Luis Pass. At its mouth there is a bar with 3 feet of water on its crest. Above this bar the depth varies from 7 to 15 feet for 50 miles from its mouth.

Amount expended on work of existing project to close of fiscal year ending June 30, 1908, $331.05.

The maximum draft that can be carried June 30, 1908, at mean low tide over the shoalest part of the locality is 3 feet.

Variation of water surface, 1 foot.

It is proposed to excavate a channel across the bar from 5 feet in the bay to 5 feet in bayou, at an expense of $9,000.

No statistics have been obtained.

No work has yet been done on this project.

Amount appropriated by river and harbor act approved March 2, 1907	$8,999.45
Transferred to Clear Creek, Texas	1,500.00
	7,499.45
June 30, 1908, amount expended during fiscal year for works of improvement	330.50
July 1, 1908, balance unexpended	7,168.95

(*j*) *Channel in West Galveston Bay.*—See Inland waterway on the coast of Texas.

(*k*) *Galveston and Brazos River Canal.*—See Inland waterway on the coast of Texas.

(See Appendix U 8.)

9. Inland waterway on the coast of Texas.—The river and harbor act of March 2, 1907, appropriated $133,829, and authorized the Secretary of War to enter into contract for materials and work to the extent of $300,000, of which $55,000 is yet to be appropriated.

This project embraces the improvement of the following localities: West Galveston Bay and Brazos River Canal; channel from Aransas Pass to Pass Cavallo, including the Guadalupe River to Victoria; Turtle Cove channel from Aransas Pass to Corpus Christi, Tex.

The object of the improvement is to obtain and maintain a navigable channel depth of 5 feet in a canal along the coast of Texas, utilizing the lagoons lying between the islands and the mainland. The improvement will develop a light-draft inland navigation which will afford cheap transportation by light-draft steamers and barges to the coast country of Texas.

More and large boats with auxiliary gas engines have been built to utilize the improvement. Most of the points to be reached are settlements which railways can not afford to develop, but the improvements are of great importance to their commercial life.

Amount expended under this appropriation to June 30, 1908, has been as follows:

West Galveston Bay and Brazos River Canal	$58,337.48
Aransas Pass to Pass Cavallo	8,312.37
Guadalupe River	26,901.58
Turtle Cove channel	339.12
Total	93,890.55

It is proposed to apply the balance available and amount estimated as a profitable expenditure in dredging, snagging, etc., in accordance with approved project.

CONSOLIDATED.

July 1, 1907, balance unexpended		$132,829.42
Amount appropriated by sundry civil act approved May 27, 1908		245,000.00
Taken up from channel in West Galveston Bay		81.90
Sales of contact prints and refundment		3.83
		377,915.15
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$72,972.32	
For maintenance of improvement	20,000.00	
		92,972.32
July 1, 1908, balance unexpended		284,942.83
July 1, 1908, outstanding liabilities		12,474.13
July 1, 1908, balance available		272,468.70
July 1, 1908, amount covered by uncompleted contracts		212,041.06
Amount (estimated) required for completion of existing project		75,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[a]155,000.00

(*a*) *West Galveston Bay and Brazos River Canal.*—These channels have been heretofore carried under another appropriation, viz, "West Galveston Bay Channel, Texas, and mouths of adjacent streams, etc."

[a] Of this amount $55,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907.

West Galveston Bay.—This is a body of water covering about 39 square miles and lies between Galveston Island and the mainland. It extends from Galveston Bay to the west end of Oyster Bay and is connected with the Gulf of Mexico by San Luis Pass at the western extremity of Galveston Island, and with the Brazos River by the Galveston and Brazos River Canal. The minimum depth of the bay was from 2½ to 3 feet. The navigable channel is 28¾ miles long.

The project adopted July 13, 1892, and modified in 1896, contemplated a least depth of 5 feet, at an estimated cost of $28,998.80.

The work done resulted in a channel 100 feet wide and 3 to 3½ feet deep from Galveston Bay to the Galveston and Brazos River Canal. Beacons were also erected to define the channel. The channel subsequently shoaled to 18 inches in places.

Amount expended on the work under previous project to close of the fiscal year ending June 30, 1907, was $35,059.69, of which $1,385.34 was for maintenance.

Expenditures under previous project resulted in opening up a channel 3 feet deep at mean low tide and 35 feet wide. The maximum draft that can be carried June 30, 1908, is 3 feet.

For report of examination, see House Document No. 640, Fifty-ninth Congress, second session.

From records kept by the Gulf, Colorado and Santa Fe Railway Company of vessels passing through the draw of its bridge across West Galveston Bay during the calendar year 1907, 4,957 vessels used the waters of West Galveston Bay.

Galveston and Brazos River Canal.—This canal was originally dredged by the Galveston and Brazos Navigation Company. The original cut was 10 miles long (made in 1851-1853), 100 feet wide at bottom, and 6 feet deep. Steamboats from 145 to 175 feet long and from 28 to 30 feet wide used the canal, carrying from 550 to 1,200 bales of cotton.

The United States purchased the canal in December, 1902, at a cost of $30,000. The canal when acquired by the United States was badly obstructed with snags, drift, and silt.

The canal has been dredged for practically its entire length to a depth of 3 feet at mean low water and width of from 35 to 40 feet. The bank has been reenforced at various points by brush.

The length of the canal, from west end of Oyster Bay to Brazos River, is 8¾ miles; ruling depth, 3 feet.

Amount expended on the canal up to the close of the fiscal year ending June 30, 1907, $67,308.86, of which $30,000 was for purchase of canal and $3,203.97 applied to maintenance.

The existing project, combining these two channels under one appropriation, was adopted by the river and harbor act of March 2, 1907, and provides for a channel 40 feet wide and 5 feet deep, at an estimated cost of $151,529, and $20,000 annually for maintenance.

The U. S. dredge *Captain C. W. Howell* has been engaged during the year in deepening channel to 5 feet, with 1 foot over depth, 40 feet wide on bottom for a distance of 33,500 feet.

The project is about one-third completed.

Amount expended on existing project to close of fiscal year ending June 30, 1908, $58,337.48, of which $20,000 was for maintenance of the improvement.

The total amount expended on the West Galveston Bay and Brazos River Canal project to June 30, 1908, is $160,706.03, of which $30,000 was for the purchase of the canal and $24,589.31 for maintenance.

The maximum draft that can be carried June 30, 1908, at mean low tide over the shoalest part of the locality is 2½ feet for a short distance.

Variation of water surface is about 1 foot, except at time of Brazos River overflow and northers.

No commercial statistics have been obtained.

WEST GALVESTON BAY AND BRAZOS RIVER CANAL.

July 1, 1907, balance unexpended		$44,156.55
Amount appropriated by sundry civil act approved May 27, 1908		92,029.00
Amount transferred from Aransas Pass to Pass Cavallo		14,500.00
Sales of contact prints		1.48
		150,687.03
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$37,494.03	
For maintenance of improvement	20,000.00	
		57,494.03
July 1, 1908, balance unexpended		93,193.00
July 1, 1908, outstanding liabilities		4,664.91
July 1, 1908, balance available		88,528.09
Amount (estimated) required for completion of existing project		20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		(a)
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

CHANNEL IN WEST GALVESTON BAY.

July 1, 1907, balance unexpended	$81.90
June 30, 1908, amount expended during fiscal year for works of improvement	81.90

(*b*) *Channel from Aransas Pass to Pass Cavallo.*—This channel was originally developed by the State of Texas and private parties and was the old United States mail route between Indianola and Corpus Christi. In 1875 vessels drawing not over 3 feet could navigate the channel.

The project as adopted by act of March 2, 1907, contemplates a depth of 5 feet, 40 feet wide, from the entrance at Aransas Pass to Matagorda Bay, a distance of about 63 miles, at a cost of $65,850.

A contract for dredging has been entered into and about one-fifth of the work has been completed.

Amount expended on existing project to close of fiscal year ending June 30, 1908, $8,312.37.

The maximum draft that can be carried at mean low tide over the shoalest part of the proposed route is 2 feet.

Variation of water surface, about three-fourths of a foot.

No commercial statistics have been received.

Report of examination is printed in House Document No. 640, Fifty-ninth Congress, second session.

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[a] See consolidated money statement on page 464.

July 1, 1907, balance unexpended	$39,923.79
Amount transferred to West Galveston Bay and Brazos River Canal	14,500.00
	25,423.79
Amount appropriated by sundry civil act approved May 27, 1908	40,350.00
Sales of contact prints	.95
	65,774.74
June 30, 1908, amount expended during fiscal year for works of improvement	8,236.16
July 1, 1908, balance unexpended	57,538.58
July 1, 1908, outstanding liabilities	1,339.92
July 1, 1908, balance available	56,198.66
July 1, 1908, amount covered by uncompleted contracts	55,646.06
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*c*) *Guadalupe River.—Bay section.*—This channel connects the mouth of the Guadalupe River with the channel from Aransas Pass to Pass Cavallo. For the first 8 miles there is 6 feet of water, shoaling to 4 feet at the twelfth mile, then through a flat with about 2 feet to the mouth of the river at the sixteenth mile.

Variation of water surface about three-fourths of a foot.

The project contemplates a navigable waterway 5 feet deep and 40 feet wide at a cost of $30,000.

A contract has been entered into for the improvement of this section of the inland waterway, which the dredge will reach about October, 1908.

River section to Victoria, Tex.—The Guadalupe River empties into San Antonio Bay 16 miles from the inland waterway on the coast of Texas. Its width varies from 90 feet at main entrance at mouth, increasing to 140 feet 52 miles above its mouth. The depth varies from less than 3 feet over shoals to 20 feet at bends. Thick overhanging trees, numerous snags, and sunken logs, together with rafts of recent formation, are found in the lower river. The river was formerly navigated to Victoria, 52 miles from its mouth, but owing to rafts navigation has been abandoned in recent years.

The project contemplates the removal of rafts, snags, etc., and the dredging of shoals to 5 feet, at a cost of $62,700.

A snag boat, rigged with a bucket for dredging, has been constructed and work commenced toward the removal of rafts, snags, etc., and the dredging of shoals to 5-foot depth.

Amount expended on existing project to close of fiscal year ending June 30, 1908, $26,901.58.

From report received from P. R. Austin, 300 bales of cotton and 100,000 feet of lumber, together with a considerable quantity of other supplies and products, have been transported over the part of the river at present navigable.

Report of examination is printed in House Document No. 336, Fifty-ninth Congress, second session.

[a] See consolidated money statement on page 464.

July 1, 1907, balance unexpended	$38,790.79
Amount appropriated by sundry civil act approved May 27, 1908	21,871.00
Refundment by civilian employee	1.00
	60,662.79
June 30, 1908, amount expended during fiscal year for works of improvement	26,862.82
July 1, 1908, balance unexpended	33,799.97
July 1, 1908, outstanding liabilities	6,409.31
July 1, 1908, balance available	27,390.66
July 1, 1908, amount covered by uncompleted contracts	40,895.00
Amount (estimated) required for completion of existing project	32,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*d*) *Turtle Cove channel between Aransas Pass and Corpus Christi.*—This is a natural depression between Harbor and Mustang islands connecting at high tide the waters of Aransas and Corpus Christi bays. It is about 13,500 feet long and 2,000 feet wide, with approximate depth of 1½ feet below mean low tide.

Variation of water surface about 1 foot.

The project contemplates a channel 8½ feet deep at low tide and 75 feet wide at the bottom, at a cost of $123,750.

A contract has been entered into for the dredging of the channel, and work will be started about July 10, 1908.

Amount expended on existing project to close of fiscal year ending June 30, 1908, $339.12.

For report of survey, see House Document No. 338, Fifty-ninth Congress, second session.

July 1, 1907, balance unexpended	$9,958.29
Amount appropriated by sundry civil act approved May 27, 1908	90,750.00
Sales of contact prints	.40
	100,708.69
June 30, 1908, amount expended during fiscal year for works of improvement	297.41
July 1, 1908, balance unexpended	100,411.28
July 1, 1908, outstanding liabilities	59.69
July 1, 1908, balance available	100,351.59
July 1, 1908, amount covered by uncompleted contracts	115,500.00
Amount (estimated) required for completion of existing project	23,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(See Appendix U 9.)

[a] See consolidated money statement on page 464.

10. Operating and care of West Galveston Bay and Brazos River :nal, Texas.—A watchman was stationed at the canal during the ar to operate the old drawbridge until the completion of the new e.

The new drawbridge was completed in September, 1907, and turned er to the county of Brazoria, to be operated and maintained by em, as per agreement with the United States. A boom tender was en appointed to tend the boom at the entrance to the canal into the azos River.

A statement contained in the report of the local engineer officer ows the items of expenditure, which amounted to $1,981.55.

(See Appendix U 10.)

11. Mouth of Brazos River, Texas.—The mouth of the river was iginally obstructed by a bar, the crest of which was about three-ghths of a mile from the shore line, and the channel across afforded variable depth of water for navigation of not over 8 feet at times n October, 1874, only 2½ to 3 feet), being subject to changes due to nds, tides, and stages of water.

The original project was adopted in 1880 for the improvement of e channel over the bar by the use of jetties. The work was sus-nded in 1889. The amount expended on original project prior to erations under existing project was $142,098.43.

After suspension of work by the United States the improvement of e mouth of this river was undertaken by the Brazos River Chan-l and Dock Company, which constructed two parallel jetties 560 et apart. The northeast jetty was 4,708 feet long and the south-est 5,018 feet. In 1899 this company complied with the conditions an act of Congress requiring a transfer to the United States of e jetties and auxiliary works; also a release of all rights and priv-ges conferred upon said company by its charter or by the act of ongress approved August 9, 1888, to charge or collect tolls for the e and navigation of said river. From the transfer of the works til the adoption of the present project the United States spent 8,524.13.

The Brazos River Channel and Dock Company's map shows that March, 1889, there was a channel depth of 6 feet before the work gan, and later, in March, 1896, there was 20 feet. The company easured their depth from a plane of "average flood tide," or mean gh water, 1.3 feet above the United States standard of mean low ater. The channel width is about 440 feet. The channel varies th storm conditions and frequency of river floods, the depth vary-g from 12 to 20 feet.

The existing project (act June 13, 1902) is to repair and strengthen e jetties, construct spur dikes and bank protection, and to dredge channel 18 feet deep and 150 feet wide. The estimated cost, 50,000, was increased by $175,000 after the hurricane of September 1900.

A contract was entered into and repairs to the jetties were com-eted during the year.

The project is complete except for the dredging necessary to obtain d maintain the channel.

The amount expended on the work of existing project up to close fiscal year ending June 30, 1908, is $218,200.58.

It is proposed to apply the balance available to maintenance of the jetties.

The latest information shows a minimum depth on the bar of 17 feet at mean low water.

Mean range of tide, 1.77 feet.

There was very little commerce using this improvement during the year.

So far this improvement has had very little effect on freight rates.

July 1, 1907, balance unexpended	$60,283.53
June 30, 1908, amount expended during fiscal year for works of improvement	42,848.01
July 1, 1908, balance unexpended	17,435.52

(See Appendix U 11.)

12. Aransas Pass, Texas.—Aransas Pass is on the south coast of Texas, 175 miles southwest of Galveston and 125 miles north of the Rio Grande, and is the outlet of Aransas Bay to the Gulf of Mexico. The area of the bay is about 80 square miles. It is connected with Corpus Christi Bay on one side and with Mesquite, St. Charles, and Copano bays on the other.

The depth over Aransas bar has varied greatly—from 9 feet in 1852, 9½ feet in 1871, 7 feet in 1875, to 8½ feet in 1887.

For projects and work done by the United States Government and private corporations at Aransas Pass, see Annual Report of the Chief of Engineers for 1898, page 1527 et seq.

Amount expended on original and modified Government project prior to operations under the Haupt project, $540,477.65, exclusive of $9,938.93 subscribed by the citizens of Rockport and Corpus Christi, Tex.

Under the provisions of the river and harbor act of March 3, 1899, the Aransas Pass Harbor Company, under date of March 27, 1899, released and surrendered all rights and privileges theretofore granted to it in Aransas Pass Harbor by Congress; also the jetties constructed in said harbor.

The river and harbor act of June 13, 1902, appropriated $250,000, and provided that the work at this harbor should be confined to the completion of the north jetty in accordance with the design and specifications of the Aransas Pass Harbor Company, and in continuation of the work theretofore carried out on said jetty by said company, and to such additional work as may be necessary for strengthening such jetty and for the removal of such part of the old Government jetty and any other hard material which may interfere with the formation of a channel by the natural action of the currents, and the act of March 3, 1905, provided for continuing the improvement, with the proviso that the amounts therein appropriated and authorized should be applied to the completion of the project in accordance with the design and specifications of the Aransas Pass Harbor Company, and in continuation of the work theretofore done, and to such additional work as might be necessary for strengthening the jetty.

Work was completed in accordance with the above-mentioned specifications June 11, 1906, at a cost to the Government of $546,703.10.

Since the completion of the Haupt jetty (so-called from the name of its inventor), in accordance with the above-mentioned specifica-

tions, the channel has become steadily worse, approaching dangerously near the jetty and showing a marked tendency to break through the interval between the north end of the jetty and the shore. The latest survey shows a minimum depth in the thalweg of 16¼ feet, but the thalweg is in places along the foot of the jetty. There is a navigable channel of only 6 feet deep and only 100 feet wide, the 6-foot contour having approached at one point to within 100 feet of the foot of the jetty. A secondary channel 600 feet wide and 6 feet deep has broken around the north end of the jetty. The 12-foot contour has approached to within 75 feet of the foot of the jetty, and the 12-foot channel is consequently not navigable for anything of a size requiring that depth.

Prior to the adoption by Congress of the plans of the Aransas Pass Harbor Company the last appropriation had been expended in accordance with the project prepared by Maj. O. H. Ernst, Corps of Engineers, in 1887 (printed on pp. 1313 to 1315 of the Annual Report of the Chief of Engineers for 1888). This project called for two parallel jetties and the revetment of Mustang Island.

The existing project, adopted by the river and harbor act of March 2, 1907, provides for improvement in accordance with plans submitted by the Board of Engineers for Rivers and Harbors in its report of December 22, 1906, printed in River and Harbor Committee Document No. 5, Fifty-ninth Congress, second session. This project provides, in the main, for a south jetty parallel to the general direction of the existing jetty and the extension shoreward of the Haupt jetty to connect with St. Josephs Island, and later the extension of both jetties. The estimated cost of the work, including $100,000 for a dredge, is $1,288,699.50. Continuing contracts to the amount of $290,000 were authorized by the act of March 2, 1907, for prosecuting the work, of which $90,000 is yet to be appropriated.

A contract for the extension shoreward of the Haupt or north jetty and the construction of a south jetty, together with the necessary wharves, railway trestle, etc., for the prosecution of the work, has been entered into and the work was in progress at the close of the year.

The amount expended on the work of revised project up to the close of the fiscal year ending June 30, 1908, was $30,725.85.

The usual range of tide is 1.1 feet across the bar.

The work done is not believed to have had any effect on freight rates as yet.

During the calendar year 1907 there was carried from and to the wharves of Corpus Christi, Tex., through Aransas Pass, Tex., 5,000,000 pounds of general merchandise and 580,000 feet (1,600,000 pounds) of lumber.

The balance available and the appropriation recommended will be applied toward completion of the present contract, dredging if necessary and extending the jetties, in accordance with the approved project.

July 1, 1907, balance unexpended	$203,325.21
Amount appropriated by sundry civil act approved May 27, 1908	200,000.00
Proceeds of sales of contact prints	3.40
	403,328.61
June 30, 1908, amount expended during fiscal year for works of improvement	29,980.16
July 1, 1908, balance unexpended	373,348.45
July 1, 1908, outstanding liabilities	8,547.30
July 1, 1908, balance available	364,801.15
July 1, 1908, amount covered by uncompleted contracts	436,495.90
Amount (estimated) required for completion of existing project	888,699.50
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 290,000.00

(See Appendix U 12.)

13. Harbor at Brazos Santiago, Tex.—The navigable depth over the bar before the improvement started was usually from 6 to 8 feet at mean low water.

The project for the improvement of this harbor, adopted in 1881, contemplated the construction of two jetties extending out into the Gulf of Mexico about 1,500 feet apart, one, the south or Brazos Island jetty, to be 3,630 feet long, and the other, the north or Padre Island jetty, to be 2,940 feet long. Work was suspended on this improvement in October, 1884, and the subject of the new improvement was reported on by The Board of Engineers. The cost of an improvement, to consist of two parallel jetties placed about 1,100 feet apart, was estimated at $1,130,000. Adding previous expenditures of $188,590.23 to this estimate makes the revised cost of the improvement $1,318,590.23. Appropriations ceased in 1888 and no work has been performed on the entrance channel since that time. No permanent increased depth was obtained over the bar.

During the fiscal year 1905 a channel 70 feet wide on the bottom, with a least depth of 10 feet, was excavated from deep water inside the bar in a straight line across the Laguna Madre to the railroad wharf at Isabel, Tex., a distance of 12,000 feet; also a turning basin 400 feet long by 300 feet wide and 10 feet deep.

Prior to dredging this channel and turning basin there was a natural channel permitting boats drawing 5½ to 6 feet to navigate across the Laguna Madre from the bar to the railroad wharf at Isabel, Tex., at high tide. With the channel and turning basin completed, light-draft steamers and sailing vessels that could get over the bar could proceed direct to the railroad wharf at Isabel, Tex., and unload, in place of being lightered off Brazos Island.

This channel has shoaled in places to less than 6 feet at mean low tide. The tidal range is from 1½ to 2 feet.

The amount expended on this improvement to June 30, 1908, was $241,913.81.

[a] Of this amount, $90,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907.

The latest information gives 8½ feet as the minimum depth on bar. No commercial statistics have been obtained.

July 1, 1907, balance unexpended	$5,586.19
Proceeds of sales of condemned property	.03
July 1, 1908, balance unexpended	5,586.22

(See Appendix U 13.)

14. Construction of sea wall, embankment, and fill along the front of Fort Crockett Reservation, Galveston, Tex., and constructing sea wall from Thirty-ninth street to the west line of Forty-fifth street, in the city of Galveston.—The sundry civil act approved April 28, 1904, contained an item for the protection of the sea front of the Fort Crockett Reservation, and appropriated $591,046.25 for the purpose.

By sundry civil act approved June 30, 1906, an additional amount of $158,953.75 was appropriated for completing the work.

Construction of the sea wall and riprap embankment along the western boundary of the reservation was completed October 18, 1905.

This work was carried out in accordance with report of Board of Engineers, dated December 19, 1902. See Appendix W 13, Report of Chief of Engineers, 1903.

The work of filling and sodding the reservation and behind the sea wall between Thirty-ninth and Forty-fifth streets was continued and is about 90 per cent completed.

A retaining wall, 95 per cent completed, is being built by contract, along the north and east sides of the reservation. On the completion of this wall the reservation will be surrounded by retaining walls.

The amount expended on existing project to June 30, 1908, was $606,403.92.

July 1, 1907, balance unexpended	$283,355.09
June 30, 1908, amount expended during fiscal year for works of improvement	139,759.82
July 1, 1908, balance unexpended	143,596.17
July 1, 1908, outstanding liabilities	32,779.33
July 1, 1908, balance available	110,816.84
July 1, 1908, amount covered by uncompleted contracts	76,329.99

(See Appendix U 14.)

15. Removing sunken vessels or craft obstructing or endangering navigation.—An old barge sunk off the entrance to Clear Creek and an oil barge sunk off Virginia Point were removed at a cost of $276.35.

(See Appendix U 15.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and survey required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of channel from Palacios through Tres Palacios Bay to Matagorda Bay, Texas.—Report dated August 7,

1907, is printed in House Document No. 448, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

2. Examination with plan and estimate of cost of Texas City channel, Texas, with a view to obtaining a channel 200 feet wide and 26 feet deep.—Reports dated June 8, and September 7, 1907, respectively, are printed in House Document No. 402, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $40,000 is presented.

The local officer was also charged with the duty of making preliminary examinations and surveys provided for in the river and harbor act of March 2, 1907, as follows, and reports thereon will be duly submitted when received:

1. Arroyo Colorado, from Harlingen to deep water at Point Isabel, Texas.

2. Pass Cavallo to Port O'Connor, Texas.

3. Colorado River, Texas.

4. Pass Cavallo to Port Lavaca, Tex.

5. Mouth of Brazos River, Texas.

IMPROVEMENT OF RIVERS AND HARBORS IN THE DALLAS, TEXAS, DISTRICT.

This district was in the charge of Capt. W. P. Wooten, Corps of Engineers. Division engineer, Col. E. H. Ruffner, Corps of Engineers..

1. Johnsons Bayou, Louisiana.—[This work was in the charge of Maj. James F. McIndoe, Corps of Engineers, to April 1, 1908.] This stream empties into Sabine Lake, Texas. Preliminary survey made in 1897 showed a minimum depth of channel of 12 feet and only 2½ feet over the bar at the mouth of the bayou.

The project of April, 1899, provided for dredging a 6-foot channel through the bar at the mouth of the bayou of such width as the appropriation ($2,500) would permit.

This work was completed during December, 1899, and a channel 6 feet deep and 60 feet wide secured.

No work has been carried on since 1899, none being considered necessary, and the unexpended balance of the appropriation, $238.65, was carried to the surplus fund in the Treasury on June 30, 1904.

The total amount expended on the original project was $2,261.35.

The river and harbor act of March 2, 1907, appropriated $2,500 for this improvement and an examination of the bar at the mouth of the bayou was made but the district officer reported that this stream is unworthy of further expenditure for either improvement or maintenance by the United States, and nothing further has been done. The amount expended up to June 30, 1908, was $46, all of which was expended on the survey and examination.

Report on examination of this stream will be found on page 1790, Annual Report of the Chief of Engineers for 1897.

July 1, 1907, balance unexpended	$2,500.00
June 30, 1908, amount expended during fiscal year	46.00
July 1, 1908, balance unexpended	2,454.00

(See Appendix V 1.)

2. Mouths of Sabine and Neches rivers, Texas.—[This work was in the charge of Maj. James F. McIndoe, Corps of Engineers, to April 1, 1908.] Prior to improvement there was 3½ feet of water over the bar at the mouth of the Sabine River, and 3 feet over the bar at the mouth of the Neches River. Dredging was carried on at the mouth of the Sabine River in 1880 and 1895, and a channel 60 feet wide and 7 feet deep secured. At the mouth of the Neches River dredging was carried on in 1880, 1889, and 1895, and a channel 50 feet wide and 5 feet in depth for a length of 8,000 feet was obtained. Funds were exhausted before deep water in Sabine Lake was reached. In 1897 the channel at the mouth of the Sabine River still afforded a depth of 7 feet, while the channel at the mouth of the Neches River had shoaled to 4 feet.

The act of March 3, 1899, appropriated $10,000 for improving the mouths of these streams, the appropriation to include the expense of reexamination of the proposed channel through Sabine Lake by a Board of Engineer officers.

The Board constituted in compliance with this act submitted, on August 11, 1899, a report on the proposed channel through Sabine Lake.

The project approved July 14, 1899, provided for dredging from deep water in Neches River to deep water in Sabine Lake. Under this project an 8-foot channel 7,829 feet in length was dredged from the 7-foot contour in Sabine Lake. A part of the appropriation was expended in deepening the channel across the bar at the mouth of the Sabine River.

The river and harbor act of March 3, 1905, adopted a project for dredging a channel 100 feet wide and 9 feet deep from the mouths of Sabine and Neches rivers to the mouth of Taylors Bayou, through Sabine Lake at or near its western shore, as outlined in a report printed in House Document No. 634, Fifty-eighth Congress, second session, at an estimated cost not to exceed $536,500, with the following provisions: "That the channel may, in the discretion of the Secretary of War, be constructed through the land near the lake for any part of said route" and "that the right of way is furnished without expense to the United States."

Work under this project was begun March 1, 1906, and completed February 20, 1908, having been badly delayed on account of difficulties in securing the right of way.

The river and harbor act of March 2, 1907, authorized the extension of the channel at its southern end to a junction with the Port Arthur Canal and the widening of the canal in front of Port Arthur. Work on the extension was begun April 8, 1908, and was completed May 23, 1908.

The amount expended to June 30, 1908, was $458,782, of which $9,925.29 was expended on original and modified projects prior to the operations under the existing project.

Comparative statement of shipments and receipts.

NECHES RIVER.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Calendar year—			
1902	145,740	.....	.....
1903	151,672	5,932	.....
1904	161,516	9,844	.....
1905	173,504	11,988	.....
1906	178,656	5,152	.....
1907	150,040	.....	28,616

SABINE RIVER.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1897	245,864	.....	25,893
1898	275,506	30,142	.....
1899	270,642	.....	4,864
Calendar year—			
1899	407,372	137,730	.....
1900	a 32,148	.....	375,224
1901	459,909	427,761	.....
1902	413,174	.....	46,735
1903	325,761	.....	87,413
1904	292,184	.....	33,577
1905	198,210	.....	93,974
1906	409,870	211,660	.....
1907	405,172	.....	4,968

a Incomplete; full statistics could not be obtained.

For reference to reports of examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 406, and page 486 of this report.

July 1, 1907, balance unexpended	$241,764.60
Amount received from sale of blueprints	1.00
	241,765.60
June 30, 1908, amount expended during fiscal year for works of improvement	154,044.00
July 1, 1908, balance unexpended	87,721.60
July 1, 1908, outstanding liabilities	93.97
July 1, 1908, balance available	87,627.63

(See Appendix V 2.)

3. Operating and care of Port Arthur Canal, Texas.—[This work was in the charge of Maj. James F. McIndoe, Corps of Engineers, to April 1, 1908.] This service is provided for by the permanent indefinite appropriation for operating and care of canals and other works of navigation, under the provisions of section 4 of the river and harbor act of July 5, 1884.

Under the provisions of an act of Congress, approved June 29, 1906, there was conveyed to the United States, free of cost, the Port Arthur Canal, the lumber basin, and the turning basin, together with a strip of land along the canal. The deed of conveyance from the

Port Arthur Channel and Dock Company was accepted by the Secretary of War on December 13, 1906, from which date the canal became a public water of the United States. Cession of jurisdiction over the property was executed by the governor of the State of Texas on February 27, 1907.

The Port Arthur Canal was built by a company interested in establishing a port somewhat removed from the Gulf, and was dredged to a depth of 25 feet. A dredge which was operated in maintaining the canal for over three years has been purchased by the United States.

A survey of the canal was completed May 10, 1907, and the follow table gives a summary of the condition of the canal upon its acceptance by the United States:

	Length.	Average top width.	Width between 20-foot contours.	Maximum depth.	Minimum depth.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Canal	87,600	200	80	25.1	22.0
Turning basin	1,800	625	530	27.1	23.7
Lumber basin	1,200	160	100	26.2	23.1

The depths above given are referred to mean low Gulf level, and the usual variation of the tide is 1½ feet.

Operations during the year have consisted in dredging shoal places in the canal and turning basin. The amount expended to June 30, 1908, was $44,911.82, exclusive of outstanding liabilities, of which $30,571.35 was expended during the past year.

(See Appendix V 3.)

4. Harbor at Sabine Pass, Tex.—[This work was in the charge of Maj. James F. McIndoe, Corps of Engineers, to April 1, 1908.] Prior to improvement there were depths of 18 and 17 feet, respectively, over the two bars in Sabine Pass, opposite the town of Sabine and opposite Fort Point. These bars were about 200 feet long. Throughout the other portions of the pass the least mean depth was 25 feet.

Beyond the shore line at the entrance to the pass there existed a bar about 3½ miles wide between the interior and exterior 18-foot bottom curves, over which there was not more than 6 feet of water at mean low tide. Channels 12 and 15 feet deep were dredged through this outer bar during 1878 and 1880, under the project of 1873, at a cost of $325,000, but they soon refilled.

The project of 1882 provided for the construction of parallel jetties at the entrance of the pass, 1,800 feet apart and about 4 miles in length from shore line to deep water in the Gulf, and for dredging the channel between these jetties if necessary. This work was designed to provide a channel of practicable width and a depth of 25 feet at an estimated cost of $3,177,606.50.

Construction of the jetties began in 1883, and under successive appropriations has been carried on since that date.

The river and harbor act of 1896 authorized contracts for the completion of the project, limiting the cost to $1,050,000.

Under contract approved June 22, 1897, the east jetty was completed for a length of 21,818 feet, riprap work only was completed

for a length of 682 feet, and foundation only for 2,600 feet. The west jetty had a length of 15,560 feet, of which 1,490 feet was only riprap work and 4,950 feet was foundation only. About 3,000 feet of previous work was capped.

Dredging in the channel was carried on, under contract, in 1897, 1898, and 1899, the depth being increased to 25 feet and the width to 100 feet. The channel was again dredged in 1900 and 1901, with an allotment of $8,000 from the emergency appropriation of June 6, 1900.

Under the act of March 3, 1899, $150,000 was appropriated for straightening, widening, and otherwise improving the harbor by the removal of oyster reefs and flats between the United States life-saving station and a point opposite the United States light-house. The work was completed April 18, 1903.

Act of June 13, 1902, appropriated $25,000 for widening and straightening the main ship channel and increasing its depth from a point 1,000 feet north of the life-saving station to the entrance of the Port Arthur Canal in accordance with report published in the Annual Report of the Chief of Engineers for 1901, page 1915. This work was completed February 27, 1903, and the channel depth was increased to 25 feet at mean low water for an average width of 400 feet.

The act of June 4, 1897, appropriated $100,000 for the construction of a dredge (the *Sabine*), which was completed January 14, 1901.

Since this date the dredge has worked in the channel between the jetties sixty-five months and twenty-six days and removed a total of 2,852,110 cubic yards. The remainder of the time she was either absent undergoing repairs or was engaged in emergency work at South Pass, Mississippi River.

The creation of the channel contemplated by the project has been completed. The existing project is for maintenance of a channel depth of 25 feet to be accomplished by dredging and the restoration of the jetties to a height of about 4 feet above mean low tide at an estimated cost of $1,016,573.

The act of March 2, 1907, appropriated $160,000 for continuing improvement and for maintenance and authorized contracts for materials or work to the amount of $200,000, of which $10,000 is yet to be appropriated.

During the year 62,901.53 tons of riprap stone has been placed under contract for raising the east jetty, completing repairs for a total distance of 6,800 feet.

At favorable stages of the tide vessels have gone out during the year drawing 25½ feet. The usual variation of the tide is 1½ feet. By continued work the dredge *Sabine* is able to maintain only a very narrow channel of about 24 feet depth, and additional work is badly needed toward building up the low portions of the jetties to a height of about 4 feet above mean low tide, and additional dredging, under contract, should be provided for in order that the full benefits of the improvement may be obtained.

The amount expended to June 30, 1908, was $3,931,814.74, of which $325,000 was expended on previous projects. Of the amount expended on the present project it is estimated that $262,839.56 has been applied to maintenance of improvement.

The amount estimated as a profitable expenditure in fiscal year *ending June 30*, 1910, will be applied to the completion of the work

under the contract referred to above, and to continuing work on the jetties and dredging to maintain the channel.

Comparative statement of shipments and receipts.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1897	87,682	88,746	.....
1898	238,400	150,768	.....
1899	326,982	88,582	.....
Calendar year—			
1899	326,494	.....	488
1900	217,489	.....	109,005
1901	150,087	.....	67,402
1902	689,688	539,601	.....
1903	1,315,248	625,560	.....
1904	1,792,371	477,123	.....
1905	1,779,954	.....	12,417
1906	1,904,389	124,435	.....
1907	1,848,159	.....	56,230

Report on effect of the improvement on freight rates is in Appendix V 4.

On page 407, Annual Report of Chief of Engineers for 1906, reference is made to previous reports on examinations and surveys of Sabine Pass.

July 1, 1907, balance unexpended		$158,834.88
Amount received from sale of blue prints		4.50
Amount appropriated by sundry civil act approved May 27, 1908		190,000.00
		348,839.38
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$125,290.53	
For maintenance of improvement	28,926.57	
		154,217.10
July 1, 1908, balance unexpended		194,622.28
July 1, 1908, outstanding liabilities		1,757.53
July 1, 1908, balance available		192,864.75
July 1, 1908, amount covered by uncompleted contracts		135,780.36
Amount (estimated) required for completion of existing project		636,573.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		[a] 210,000.00

(See Appendix V 4.)

5. *Brazos River, Texas, from Old Washington to Waco.*—Originally this section of the river was ordinarily not navigable above Hidalgo Falls. From there to Waco the profile of the river is an alternating series of steep and gentle slopes, rendering it susceptible of effective improvement by a combination of locks and dams with open-channel work between.

In the river and harbor act of March 3, 1905, an examination of this section was ordered and a provisional appropriation for its improvement was made. In the act of March 2, 1907, a further appropriation was made, in accordance with a project submitted in a

[a] Of this amount $10,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907.

report published in House Document No. 705, Fifty-ninth Congress, first session. This project contemplates securing a navigable depth of 4 feet for four months and 3½ feet for six months of the year by constructing eight locks and dams and 103 miles of open-channel work, at a total cost of $2,915,000. It is not clear to what extent the project outlined therein may be regarded as adopted by Congress in appropriating for the work, and in the money statement given below it is assumed that the Government is committed to the construction of only one lock and dam at an estimated cost of $300,000.

The river and harbor act of March 2, 1907, authorized continuing contracts in the sum of $150,000, in addition to amounts already appropriated for the completion of the lock and dam at Hidalgo Falls, of which $50,000 is still to be appropriated.

On June 30, 1908, $148,586.60 had been expended on this project in the construction of a lock and dam at Hidalgo Falls.

As the work on this section has just begun, no results in the way of increased depths have yet been obtained, and no commerce has had an opportunity to develop.

Taken in connection with the improvement of the lower section of the river, when its navigable capacity is fully developed it should have a very pronounced effect, not only on freight rates in the section which it traverses, but also on rates from more distant points, as the freights carried on roads traversing its valley are heavy and the rates high.

The available balance will be applied to the continuance of the construction of Lock and Dam No. 1 at Hidalgo Falls. The additional appropriation requested will be applied to completing this work.

For references to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1907, page 453.

If it is the intention of Congress to continue the improvement by the construction of additional locks and dams money should be provided for the necessary surveys to locate sites and for acquisition of land required for the additional locks and dams to be constructed under the adopted project in order to avoid delays incident to such work after appropriations for actual construction have been made.

July 1, 1907, balance unexpended	$62,251.31
Amount refunded account disallowance of voucher	.96
Amount appropriated by sundry civil act approved May 27, 1908	100,000.00
	162,252.27
June 30, 1908, amount expended during fiscal year for works of improvement	60,837.91
July 1, 1908, balance unexpended	101,414.36
July 1, 1908, outstanding liabilities	1,080.68
July 1, 1908, balance available	100,333.68
Amount (estimated) required for completion of existing project	[a] 50,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	[a] 50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(*See Appendix V 5.*)

[a] For lock and dam at Hidalgo Falls.

6. Brazos River, Texas, from Velasco to Old Washington.—This section of the river has a width of from 200 to 400 feet. It has good depth from the mouth to near the head of tide water above Columbia (mile 36). It is navigable for light-draft boats throughout its length for about eight months in the year.

The original project for this improvement was adopted June 3, 1896, and contemplated the removal of snags and overhanging trees and dredging troublesome shoals between Velasco and Richmond only. The sum of $5,000 was expended on this project.

In the river and harbor act of June 13, 1902, the improvement from Richmond to Old Washington was undertaken. In the act of March 3, 1905, this improvement was continued from Velasco to Old Washington. The project on which these appropriations were based (see Report of the Chief of Engineers, 1901, p. 1974) contemplated the improvement of the river by open-channel work between the mouth and Old Washington, at a cost of $225,000.

Amount expended on work of existing project up to June 30, 1908, was $195,673.22.

Operations during the year consisted in construction of jetties for regulating the channel and in removal of obstructions by snagging.

A depth of 4 feet for approximately eight months in the year has been obtained.

Complete statistics as to commerce have not been obtainable, but the leading articles hauled are sugar, molasses, oil, wood, and provisions. The freight handled can not be a maximum, and a reduction in rates can not be effected until the section of the river between Old Washington and Waco is made navigable.

It is proposed to apply the available balance to continuing and maintaining the improvement.

For references to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1907, page 454.

July 1, 1907, balance unexpended	$72,454.52
June 30, 1908, amount expended during fiscal year for works of improvement	18,127.74
July 1, 1908, balance unexpended	54,326.78
July 1, 1908, outstanding liabilities	674.10
July 1, 1908, balance available	53,652.68

(See Appendix V 6.)

7. Trinity River, Texas.—The river in its upper reaches is a narrow stream with a low-water depth insufficient for even light-draft navigation. Its banks are generally high and quite stable, making it particularly susceptible to improvement by canalization.

The river and harbor act of June 13, 1902, adopted a project for the improvement of this stream in accordance with a report submitted in House Document No. 409, Fifty-sixth Congress, first session. (See Annual Report of the Chief of Engineers for 1900, p. 2348.) This project contemplated improvement to provide a 6-foot navigation from Dallas to the mouth, a distance of 511 miles, by open-channel work and a system of locks and dams.

The original estimate of cost of this improvement was $4,550,000. The portion of this applicable to section 1 ($350,000) was afterwards raised to $918,000 in a report from a Board of Engineers appointed to

examine into the cost. (See Annual Report of the Chief of Engineers for 1904, p. 2021.)

The amount expended on this improvement up to June 30, 1908, was $310,518.58.

Four locks and dams in section 1 have already been provided for by Congress. The money for Nos. 1, 2, and 6 has already been appropriated, and funds have been appropriated and pledged for No. 4 and for a lock and dam at Hurricane shoals, which is in section 2, and is estimated to cost $160,000. An authorization of $210,000 for these locks is still to be appropriated.

The expenditures made in cleaning the river have resulted in no increased depth, but the removal of snags and drifts has made the stream safer to navigate at medium and high stages. There is no navigation of account above Liberty other than the rafting of logs.

Owing to the fact that the river is not yet navigable to Dallas, the only place at which it can come into active competition with the railroads, no effect on freight rates has been produced. Inasmuch as the leading trunk lines of this section are crossed by the river at Dallas, there can be no doubt that when the river is made navigable to this point it will result in a considerable reduction and an immense saving, not only in local, but also in interstate freight rates in this section.

It is proposed to apply the available balance and the additional appropriation asked for to the completion of locks and dams already authorized, and to further improvements in the prosecution of the existing project.

For references to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1906, page 431.

If it be decided to prosecute this project further, provision should be made for the necessary surveys to locate sites and for acquisition of land required for the additional locks and dams to be constructed under the adopted project, in order to avoid delays incident to such work after appropriations for actual construction have been made.

July 1, 1907, balance unexpended		$486,925.25
Sales of condemned property and blueprints		77.77
Amount appropriated by sundry civil act approved May 27, 1908		90,000.00
Refundment for overpayment		.18
		577,003.20
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$63,751.09	
For maintenance of improvement	24,374.47	
		88,125.56
July 1, 1908, balance unexpended		488,877.64
July 1, 1908, outstanding liabilities		2,154.12
July 1, 1908, balance available		486,723.52
July 1, 1908, amount covered by uncompleted contracts		467,090.78
Amount (estimated) required for completion of existing project		[a] 210,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908		[a] 125,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix V 7.)

[a] Applies only to such work as Congress has specifically authorized under the continuing-contract system.

8. Cypress Bayou, Texas and Louisiana.—During the period of the great raft in Red River the bottom lands of Cypress Bayou were flooded—became lakes—and afforded a navigable route from Red River near Shreveport, La., to Jefferson, Tex., 65 miles. Work by the United States for the improvement of this route commenced in 1872, and from 1872 to 1879, $94,000 was appropriated for the purpose. The funds were expended for dredging and straightening the channel, removing stumps, snags, and logs, and cutting leaning timber. This work was completed in 1880, but on account of its temporary nature appropriations and allotments aggregating $39,701.33 were made for maintenance.

The removal of the raft and the subsequent closure of outlets and construction of levees down the right bank of Red River from the hills in Arkansas to near Shreveport, La., cut off the water supply of the lakes, which, in conjunction with the quicker drainage resulting from the lowering of the bed of Red River, gradually caused them to dry up. In consequence the period of navigation shortened from year to year until 1897, when boats from Red River ceased plying altogether.

The existing project is practically for maintenance by cleaning and clearing the bayou and lakes between Jefferson, Tex., and Mooringsport, La., of snags and other recurring obstructions.

The amount expended to June 30, 1908, was $139,452.29 for improvement and maintenance and $12,613.05 for surveys. The work of maintenance so merges into the work of improvement that it is difficult to state just what portion of the expenditures was for maintenance and what for improvement.

The water supply of the drainage basin of the lakes has been reduced so greatly and the channel of Red River above Shreveport has lowered so much that steamboats now can cross Albany flats, at foot of the lake, only at rare intervals during exceptionally high stages of Red River or after heavy rains in the drainage basin of the lakes.

The work of removing obstructions now in progress has rendered navigation safer between Jefferson and Mooringsport and has consequently caused some increase in the quantity of such local navigation. This navigation by giving access to a competing railroad has resulted in keeping freight rates somewhat below those existing in neighboring sections.

It is proposed to apply the available balance to removing obstructions from the channel and marking channel through the lakes.

For references to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1906, page 432.

During the year an examination was made of "Caddo Lake with a view to determining advisability of constructing a dam at the foot of said lake on the waterway connecting Jefferson, Tex., with Shreveport, La." The report of this examination was published in House Document No. 220, Sixtieth Congress, first session.

July 1, 1907, balance unexpended	$8,397.67
Refundment for overpayment	2.03
	8,399.70
June 30, 1908, amount expended during fiscal year for works of improvement	4,761.68
July 1, 1908, balance unexpended	3,638.02
July 1, 1908, outstanding liabilities	140.54
July 1, 1908, balance available	3,497.48

(See Appendix V 8.)

9. Red River between Fulton, Ark., and Denison, Tex.—This part of the river was originally navigable for small boats during high stages only. The river at low water is a stream from 100 to 200 feet wide in the bends, winding in a shifting channel between banks which are frequently several hundred yards apart. The low-water depth varies from 1.5 to about 4 feet. The banks are covered with trees constantly caving into the river and forming snags and drifts.

The original appropriation for work above Fulton was made August 5, 1886. The project contemplated improving only high and medium stage navigation by removing snags and drift. Previous to the existing project no work was provided for above the mouth of the Kiamichi River. The amount expended under previous projects is $33,500.

The river and harbor act of March 3, 1905, entered upon a project for the improvement of the river between Fulton, Ark., and Denison, Tex. The project contemplates the removal of drift and snags, clearing the banks of timber in danger of caving into the river, and closing chutes and cut-offs where necessary. No estimate of cost has been made.

At the close of the fiscal year $129,151.70 had been expended on this project.

During the year the construction of a snag boat, the *Culberson*, has been completed and operations have consisted in the removal of obstructions and a survey of the river to the mouth of the Washita.

The work done under this project has not brought out any material increase of depth or width, but has resulted in the removal of a number of snags and other obstructions, and has rendered navigation less dangerous. At mean low water the river is not navigable in its shoalest parts by boats drawing more than 1.5 feet. The usual variation between high and low water is about 30 feet. During medium and high stages this section of the river is navigable throughout its whole length of 292 miles.

Beyond the rafting of logs and timber there has been no commerce of any value on this section of the river.

When this section of Red River is opened to regular navigation a very material reduction in both local and through freight rates to points in north Texas and Oklahoma must necessarily result.

To secure a stable improvement will require a continuance of work for a number of years. The available balance will be applied to continuing the work now under way of removing obstructions and bank clearing.

For references to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1906, page 433.

July 1, 1907, balance unexpended		$132,443.91
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$56,193.60	
For survey	5,402.01	
		61,595.61
July 1, 1908, balance unexpended		70,848.30
July 1, 1908, outstanding liabilities		2,466.67
July 1, 1908, balance available		68,381.63
July 1, 1908, amount covered by uncompleted contracts		2,184.00

(See Appendix V 9.)

10. Sulphur River, Texas and Arkansas.—Sulphur River for about 150 miles from its mouth is from 150 to 200 feet wide, with navigable depths, except for a few shoals. The banks are as a rule firm and stable. The stream is, however, badly obstructed by snags and sunken logs.

In 1896 and 1897 the sum of $2,488.99 was expended on snagging operations.

The existing project was adopted by the river and harbor act of March 2, 1907, and contemplates improvement of 150 miles of the river above the Red River by dredging and operation of a snag boat, at an estimated cost of $36,000, assuming that a United States boat is available. Operations during the year consisted in removal of snags and other obstructions.

At the close of the fiscal year $8,139.16 had been expended on this project.

Owing to the poor navigable condition of the stream at present no commerce of any account has developed. As the stream drains a very rich section of the country it is expected that it will be extensively used when improved, and that some reduction in freight rates will result.

It is proposed to expend the available balance in clearing the river of obstructions and dredging where necessary.

For reference to reports of examinations and surveys see Annual Report of the Chief of Engineers for 1907, page 457.

July 1, 1907, balance unexpended	$36,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	8,139.16
July 1, 1908, balance unexpended	27,860.84
July 1, 1908, outstanding liabilities	180.10
July 1, 1908, balance available	27,680.74

(See Appendix V 10.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination with plan and estimate of cost of improvement of Caddo Lake, with a view to constructing a dam at the foot of said lake on the waterway connecting Jefferson, Tex., with Shreveport, La.—Reports dated July 27 and November 2, 1907, respectively, are printed in House Document No. 220, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $100,000 is presented.

2. Preliminary examination of Sabine River from its mouth to Logansport, La., and Belzora, Tex.—Report dated December 11, 1907, is printed in House Document No. 490, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

3. Preliminary examination with plan and estimate of cost of improvement of Neches River, Texas.—Reports dated December 6, 1907, and February 7, 1908, are printed in House Document No. 870, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $15,000 is presented.

Pursuant to a requirement in section one of the river and harbor act of March 2, 1907, a Board of Engineers has been appointed to examine that portion of the *Red River which lies between Fulton, Ark., and mouth of Washita River, Indian Territory.* The Board's report will be duly submitted.

IMPROVEMENT OF RIVERS AND HARBORS IN THE VICKSBURG, MISSISSIPPI, DISTRICT.

This district was in the charge of Capt. G. M. Hoffman, Corps of Engineers, to December 15, 1907, and in the charge of Capt. Clarke S. Smith, Corps of Engineers, since that date. Division engineer, Col. E. H. Ruffner, Corps of Engineers, to March 16, 1908, and Col. W. H. Bixby, Corps of Engineers, since that date.

1. Red River, below Fulton, Ark.—This improvement was undertaken by the United States in 1828, and between 1828 and 1841 more than $425,000 was appropriated for removal of the great Red River raft. When work commenced the raft was 92 miles long, extending from Loggy Bayou, 65 miles below Shreveport, La., to Hurricane Bluffs, 27 miles above. A channel was opened through this obstruction, but, owing to failure of appropriations between 1841 and 1852, additional raft formed. In 1852 $100,000 was appropriated, and in 1857 the agent in charge reported the route opened but not completed, with recommendation for appropriations of $50,000 a year for completion and maintenance. The total amount expended from 1828 to 1857 was $532,219.90. Nothing further was done for fifteen years, and in that long interval the results of much of the former work were lost.

When work was resumed, in 1872, the river above Shreveport, La., was closed by a raft 32 miles long, which was growing constantly. Below Shreveport the enlargement of an outlet through Tones Bayou was depleting the main channel and threatening its closure to navigation. At Alexandria, La., the falls were impassable at low stages. Navigation was difficult and dangerous at all places and at all times. The channel shifted frequently, and at flood the river overflowed the entire raft region. Both above and below Shreveport the bed of the

river was a mass of sunken logs and stumps. The banks were heavily timbered and each flood caused them to cave or slide.

The project entered upon in 1872 contemplated opening navigation through the raft and closing Tones Bayou outlet. Under the river and harbor act of 1878 the removal of wrecks, snags, and other obstructions below Shreveport was commenced, and the act of 1879 authorized the same kind of work above the raft to Fulton, Ark. Work was carried on under three distinct appropriations until 1882, when it was combined in a general appropriation for continuing the improvement from Fulton, Ark., to the Atchafalaya River, Louisiana, with a provision for work at Alexandria, La. The river and harbor acts of 1884 and 1890 contained provisions for closing Sale and Murphy outlet, Louisiana; the acts of 1888, 1892, and 1894 authorized expenditures for improvement of Cypress Bayou, Bayou Dorcheat, and Sulphur River, tributaries of Red River; the act of 1902 provided for improvement of the channel at Shreveport, La., and the act of 1905 contained a provision for further improvement of the channel at Alexandria, La.

The existing project, adopted by Congress in the river and harbor act of July 13, 1892, contemplates the systematic clearing of the banks to remove the source of drift and snags; continuing snagging operations and the removal of jams and raft; dredging tow-heads and shoals; constructing a substantial system of levees to fix the course of the river, either alone or by cooperating with riparian States; the closure of all outlets that deplete the river; the fixing of caving banks to confine the river to the selected channel, and the prevention of injuries to regimen by new cut-offs or outlets. The nature of the improvement requires that it be continued for many years, and no estimate for completion is given on this account.

The amount expended from 1872 to the close of the fiscal year ending June 30, 1908, including $5,416.97 derived from sales and $43.11 from refundments of overpayments, was $1,758,266.48, with the following chief results: The channel cleared through the great raft in 1872–73 opened to navigation 188 miles of river above Shreveport to Fulton. Subsequent work secured the complete removal of the raft, prevented formations of the same nature, increased the width of the river 100 feet or more, and there now flows in the course laid out for it in the old raft region a broad and deep river, safe for navigation at all but the lowest stages. Sixteen years ago the survey showed that the low-water line at head of the raft had lowered more than 15 feet since 1872, and that this change continued downstream through the raft region and gradually diminished to about 3 feet at Shreveport. The continual progressive scour is attaining a normal slope in that stretch. Incidentally the removal of the raft drained the fertile valley and reclaimed thousands of acres of productive lands. Tones Bayou outlet is closed by a heavy earthen dam, connected with the line of levee above and below it, and the main channel, for a time called "Little River," has widened and scoured until navigation of the stretch is uninterrupted at low stages. All of the chief outlets along the right bank above Tones Bayou to the Arkansas-Louisiana line, 89 miles, have been closed with dams by cooperation with the State of Louisiana and local levee districts. Work at Alexandria Falls rendered them navigable at all stages. The channel was deepened from 2½ to 5½ feet at the lower falls and to 6 feet at the upper

falls, lengthening the period of navigation about two months. Persistent snagging operations, repeated from year to year, have kept the river open and enabled steamboats to make regular trips, the river from the Atchafalaya to Fulton ordinarily being open for boats of 3-foot draft at stages about a foot above zero of the Shreveport gauge. The maximum draft that can be carried at mean low water is 3 feet to Montgomery, La., 162.5 miles above the Atchafalaya; 2½ feet to Shreveport, 320.5 miles, and 2 feet to Fulton, Ark., 508.6 miles. The range between low and high water at the several gauge stations is as follows: Fulton, Ark., 35.65 feet; Shreveport, La., 41.2 feet; Alexandria, La., 41.95 feet, and Barbre Landing, Louisiana (head of Atchafalaya River), 52.72 feet.

At present steamboats seldom run above Fulton, Ark., but at high stages the river is navigable in fact to Denison, Tex., 292 miles above Fulton and 800 miles above the Atchafalaya River.

During the fiscal year ending June 30, 1908, snagging operations, etc., for maintenance of the improvement extended over the river between the head of the Atchafalaya River, Louisiana, and Fulton, Ark., and in the autumn of 1907 the upper and lower dikes at Alexandria, La., were repaired and strengthened, and their full effect appears to have been reestablished.

To maintain what has been accomplished and to gradually secure a more stable improvement will require a continuance of work for many years. The estimated cost is $75,000 a year, or biennial appropriations of $150,000, exclusive of extraordinary demands for new plant that will arise from time to time. The available funds will be applied to continuing the improvement and to maintenance.

Notwithstanding the facilities for quick transportation afforded by railways, the commerce of Red River consists of large shipments of cotton, cotton seed and its products, lumber, staves, timber, etc., with heavy return freights of general merchandise and plantation supplies.

The commerce and navigation reported for eighteen years show great variations, due to the changing crop conditions, occasional periods of extraordinary low water during the busy season, and other causes, ranging in quantity from 66,376 to 279,946 tons per annum, with estimated values of from $1,506,500 to $9,185,000. The average for the eighteen years is 123,244 tons, valued at $4,359,900. To this should be added the commerce from Ouachita River, entering Red River at the mouth of Black River, the average of which is 178,070 tons, valued at $6,229,560, making a total of 301,314 tons, valued at $10,589,460.

The project has effected a reduction of freight rates on all commodities.

For more extended information respecting the work performed, reference is invited to the report and illustrations at page 1909 of the Report of the Chief of Engineers for 1893, and to the subsequent reports of the district officers. Maps of Tones Bayou, Bayou Pierre, etc., were published in the reports of 1882, page 1542, and 1885, page 1490. An index sketch of the basin of Red River and diagrams showing the limits of high and low water were published in the report of 1891, page 1956, and the report of 1892, page 1587. Maps of the river at Shreveport were published in the reports of 1887,

page 2682, and 1893, page 1921. Map of the river at Alexandria was printed in House Document No. 462, Fifty-sixth Congress, first session.

References were given in the Annual Report of 1904 to reports of examinations and surveys, with page numbers at which they may be found. (See Report of the Chief of Engineers, 1904, pp. 385 and 386.)

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908, will be applied to the operation of snag boats and further work on the existing approved project. This additional work is for maintenance and the extension of benefits.

July 1, 1907, balance unexpended	$244,978.48
June 30, 1908, amount expended during fiscal year for maintenance of improvement	47,784.88
July 1, 1908, balance unexpended	197,193.60
July 1, 1908, outstanding liabilities	4,368.88
July 1, 1908, balance available	192,824.72
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	75,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix W 1.)

2. Ouachita and Black rivers, Arkansas and Louisiana.—The improvement of Ouachita River by the United States commenced in 1871. At that time navigation was much obstructed at all stages by snags, sunken logs, wrecks, leaning and caving trees, etc., and the greater part of the river was unnavigable at low water on account of numerous rock, gravel, and sand bars.

The project of 1871 contemplated temporary improvement from Trinity, La., to Arkadelphia, Ark., by removal of snags, etc., and by dredging the worst bars. In 1872 a project was adopted for locks and dams to give 4 feet depth from Trinity, La., to Camden, Ark., but was abandoned two years later. The project under which work continued after 1874 contemplated the removal of snags, logs, wrecks, leaning timber, etc., obstructing navigation below Camden, Ark. The 56 miles known as Black River, below Trinity to Red River, Louisiana, was added to the project in 1884. The amount expended on the original and modified projects prior to operations under the existing project was $605,947.19, including $145 derived from refundments of overpayments.

The existing project, besides a continuation of snagging work, contemplates the construction of nine locks and movable dams to afford a navigable depth of 6½ feet from the mouth of Black River, Louisiana, upstream to a point 10 miles above Camden, Ark. (360 miles). The original estimate of cost, $1,998,576, was increased to $2,109,980 by river and harbor acts of March 3, 1905, and March 2, 1907. The project was adopted in part by a provision in the river and harbor acts of June 13, 1902, and March 3, 1905, authorizing continuing contracts (of which $40,312 yet remains to be appropriated) for building Lock and Dam No. 4, near Monroe, La., and Lock and Dam No. 6, near Roland Raft, Ark., completing the survey for locks and dams,

and maintenance of prior work. The river and harbor act of March 2, 1907, authorized continuing contracts in the sum of $360,823, of which $135,823 is yet to be appropriated for the construction of Lock and Dam No. 2, near Catahoula shoals, Louisiana, and Lock and Dam No. 8, near Franklin shoals, Arkansas.

The amount expended under the existing project to June 30, 1908, was $315,259.66 (including $1,572.61 derived from sales and 35 cents from overpayments). Of this amount $11,786.73 has been applied to completion of survey and $87,215.05 to maintenance.

A contract for building Locks and Dams Nos. 4 and 6, let September 7, 1904, provided for their completion by December 31, 1906, but this time limit has been waived. Work commenced October 28, 1904, but abnormally high river stages limited the time of actual construction to two hundred and ten working days during the fiscal years 1905, 1906, 1907, and 1908. Previous gauge records for fourteen years, from July, 1890, to July, 1904, showed the yearly average working stage (below 10 feet on the Monroe gauge) to be one hundred and forty-one working days. On June 30, 1908, the condition of the work was as follows: On the basis of work done, Lock and Dam No. 4 about 20 per cent completed, Lock and Dam No. 6 about 8 per cent completed. On the basis of work done and material delivered, Lock and Dam No. 4 is about 31 per cent completed, and Lock and Dam No. 6 about 11 per cent completed.

On account of insecure foundations below Harrisonburg, La., a change of the site of Lock and Dam No. 2 to a location about one-fourth mile above Harrisonburg was authorized November 9, 1907. Bids for construction are to be opened July 13, 1908. This new location will eliminate Lock and Dam No. 1 from the project.

Proposals for building Lock and Dam No. 8 were invited by newspaper advertisement for two months, but only one bid was received, which was rejected as excessive, and the execution of work by hired labor and purchase of materials has been authorized. Preparations have been made for prosecuting the work to the fullest extent possible during the low-water season.

During the fiscal year ending June 30, 1908, snagging work for maintenance extended from the mouth of Saline River, Arkansas, to Jonesville, La., with greatly beneficial results. The new steel snag boat *Jos. E. Ransdell*, built under contract, was completed and delivered at Vicksburg, Miss., May 30, 1908.

While a large saving in the cost of the improvement of the river by the proposed system of locks and dams has been effected by the elimination of Lock and Dam No. 1 from the project, it is estimated that the cost of Locks and Dams Nos. 2 and 8 will exceed the original estimates on account of the more extensive structure required for Lock and Dam No. 2 due to the change in location, the additions to the original design thought necessary, the necessary purchase of plant for the construction of Lock and Dam No. 8 by hired labor, and the increased cost of superintendence, owing to the longer time required for construction than originally estimated, etc. The amount estimated as required to complete the existing project has therefore been increased $294,000 to cover the cost of these two locks and dams, and this amount is included in the estimate for the fiscal year 1910. Should the contractors for locks and dams Nos. 4 and 6 fail to carry out their present contract and the work be relet, or be carried on by hired labor, additional funds for these works may also be necessary.

The short working season on Ouachita River, the alluvial nature of the river bottom, which requires the use of piling for foundations in lock and dam structures, the necessity of obtaining detailed information as to the character of the underlying material, and the desirability of making tests, plans, and local surveys render it advisable to have funds available for expenditure in preliminary work at lock and dam sites proposed in the general project for improvement other than those for which funds have been provided. Such a provision would expedite the work when funds for construction are provided and would permit of an economical arrangement for labor and plant. It is recommended that $8,000 be provided for these purposes.

Besides the slack-water improvement the work heretofore done has consisted chiefly of the removal of snags, logs, wrecks, leaning timber, tree slides, etc., for the purpose of maintaining navigation and the improvement of Catahoula shoals, a rock and gravel bar about 20 miles above Trinity, La., where the available depth at low water was increased from 15 to 40 inches. At moderately high stages, or for six to seven months of the year, New Orleans steamboats ascend the river to Camden, Ark.; at medium stages they run to Monroe, La., but during the periods of low water Harrisonburg, La., 72 miles above Red River, is considered the head of navigation, though small local packets make trips between points on the river above. The maximum draft that can be carried at mean low water is 3½ feet to Harrisonburg, La.; 1¼ feet to Monroe La., and 8 inches to Camden, Ark. The range between high and low water at the several gauge stations on Ouachita River is as follows: Camden, Ark., 44.2 feet; Monroe, La., 48.6 feet; Riverton, La., 51.3 feet, and Jonesville, La., 54.1 feet. Camden, Ark., is considered the head of navigation, but at high stages the river is navigable in fact to Arkadelphia, Ark.

The commerce of Ouachita River and its tributaries is considerable and consists of shipments of cotton, cotton seed, lumber, staves, saw logs, and miscellaneous articles, with return freights of general merchandise and plantation supplies. Most of the cotton is shipped to New Orleans, and large quantities of staves for export are sent to that city. The volume of commerce, as reported for eighteen years, ranges between 73,679 and 313,863 tons per annum, with values estimated at $3,243,200 to $10,234,250. The average is 178,070 tons, valued at $6,229,560. The variations are due to crop yields, the uncertainty of navigation, droughts, and other causes, and the improvement by locks and dams is for an extension of benefits by affording navigation to Camden the year round.

The project has effected a reduction of railroad rates from New Orleans to Monroe, La., and points below to meet the steamboat rates. The territory above Monroe was opened to railroad traffic a few years ago, but the lines as yet have not met the water rates. During periods of navigation the rate on cotton from Monroe to New Orleans is $1.25 per bale, but when navigation is suspended this rate is advanced to $1.75 per bale. Railroad rates from Monroe, La., to inland towns, as a rule, are greatly in excess of those to points where there is water competition.

For more extended information respecting this improvement, reference is invited to the Report of 1895 (p. 1887) and to subsequent reports of the district officers.

An index to reports of examinations and surveys was published in the Report of the Chief of Engineers, 1904, page 389.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908, will be applied to continuing construction of locks and dams; to removing obstructions, including snags, overhanging trees, drift, etc., and to maintaining and operating snag and dredge boats. This additional work is necessary to make the improvement available and for maintenance and the extension of benefits.

July 1, 1907, balance unexpended		$599,724.87
Amount received from sales of property		28.40
Amount appropriated by sundry civil act approved May 27, 1908		225,000.00
		824,753.27
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$137,672.82	
For constructing snag boat	9,673.23	
For maintenance of improvement	12,883.41	
For survey	278.70	
		160,508.16
July 1, 1908, balance unexpended		664,245.11
July 1, 1908, outstanding liabilities		31,860.60
July 1, 1908, balance available		632,384.51
July 1, 1908, amount covered by uncompleted contracts		372,026.43
Amount (estimated) required for completion of existing project		[a] 470,135.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		[b] 510,135.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix W 2.)

3. Bayou Bartholomew, Boeuf River, Tensas River and Bayou Maçon, and Bayous D'Arbonne and Corney, Louisiana and Arkansas.—These streams are tributaries of Ouachita River and are not navigable at low stages. The works were consolidated by the river and harbor act of June 13, 1902. The improvements are all of the same character, i. e., the removal of snags, wrecks, leaning timber, etc., to lessen the danger and lengthen the period of navigation. Drift, sliding and caving banks, and the rapid growth of vegetation constantly add obstructions.

(*a*) *Bayou Bartholomew, Louisiana and Arkansas.*—Before improvement this stream was navigable for light boats about three months of the year. In 1880 an examination showed that passageway for steamboats was much obstructed.

The project adopted March 3, 1881, contemplated removing obstructions between the mouth and Baxter, Ark., 182 miles.

The amount expended to June 30, 1908, was $64,979.51. The project practically was completed in 1897 to McComb Landing, Ark.,

[a] The estimate for completion refers only to that part of the project authorized by Congress for construction of Locks and Dams Nos. 2, 4, 6, and 8, at a cost of $1,289,869.

[b] Of this amount, $40,312 is for continuing-contract work authorized by the river and harbor act of March 3, 1905, and $135,823 for work authorized by the act of March 2, 1907; $294,000 for completing locks and dams Nos. 2 and 8, already authorized; and $40,000 for work of maintenance.

the present head of navigation, 141 miles, at a cost of $45,873.53. This work resulted in safer navigation, increased the period to about six months of the year, enabled boats to make trips in half the time formerly required, and reduced freight rates about 50 per cent. There being no demand for navigation above McComb Landing, subsequent expenditures were for maintenance, and $19,105.98 has been applied to that purpose.

Operations for maintenance during the fiscal year ending June 30, 1908, extended from McComb Landing to the mouth and put the stream in fair navigable condition.

The commerce consists of shipments of cotton, cotton seed, staves, saw logs, etc., with return freights of general merchandise and plantation supplies. Much of the trade has been diverted to railroads, as the stages of the bayou frequently are not coincident with the needs of transportation. The commerce for eighteen years ranges between a maximum of 49,299 tons in 1891 and a minimum of 1,502 tons in 1907, the average being 12,500 tons, valued at $317,900.

The available funds will be applied to maintenance.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908, will be applied to removal of obstructions, including snags, overhanging trees, drift, etc. This additional work is for maintenance and extension of benefits.

July 1, 1907, balance unexpended	$5,412.56
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,392.07
July 1, 1908, balance unexpended	2,020.49
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *Boeuf River, Louisiana.*—Before improvement this river was navigable to Point Jefferson, 151 miles, but passage was difficult and dangerous on account of overhanging timber and snags and logs in the channel.

The project adopted March 3, 1881, contemplated removing these obstructions to afford safe navigation at high stages to Wallace Landing, La., about 170 miles above the mouth. Under the river and harbor act of 1886 a supplemental project was entered upon for the closure of three outlets near Point Jefferson to confine the flow to the main channel.

The total expenditure to June 30, 1908, was $64,913.86. The original project was completed in 1896 at a cost of $40,994.29 (including $1.45 from a refundment of overpayment). Since then $18,477.79 (including $31 from a refundment of overpayment) has been expended for maintenance. In 1887–88, by uniting with planters whose lands would be protected from overflow, the outlets near Point Jefferson were closed by earthen dams, the proportion of the cost borne by the United States having been $5,441.78.

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[a] See consolidated money statement on page 496.

The work put the stream in safe navigable condition at stages high enough to permit steamboats to cross the bars and, when completed, enabled them to save thirty-six hours' time on a trip.

The closure of the outlets gave immediate benefit to navigation by concentrating the flow to the main stream, lengthening the period of navigation, and causing the bars to scour. The dams, however, were destroyed in 1890, during an overflow from Mississippi River, caused by crevasses in the levees near the headwaters of Boeuf River, and funds for their restoration have not been provided.

Three days' work was performed in December, 1907, in the 6 miles of Boeuf River immediately above its mouth, but was then suspended by high water, and conditions were not favorable to a resumption of operations to end of the fiscal year.

The commerce consists of shipments of cotton, cotton seed, staves, etc., and return freights of general merchandise and plantation supplies, and for eighteen years ranges between a maximum of 11,261 tons in 1897 and a minimum of 545 tons in 1903, the average being 5,600 tons, valued at $238,480.

The available funds and the additional amount estimated for the fiscal year 1910 will be applied to maintenance by the removal of obstructions, including snags, overhanging trees, drift, etc. This additional work is for extension of benefits.

Steamboat men report that navigation is becoming more difficult each year, and additional interest in the project for again closing the outlets at Point Jefferson has revived through the necessity of draining Bayou Lafourche Basin, into which the outlets flow, to permit development of a rich tract of land containing 220,800 acres, much of which has been converted into a swamp and all of which is seriously affected by flood water from Boeuf River.

July 1, 1907, balance unexpended	$5,642.77
June 30, 1908, amount expended during fiscal year for maintenance of improvement	124.18
July 1, 1908, balance unexpended	5,518.59
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*c*) *Tensas River and Bayou Maçon.*—Before improvement these streams were navigable at high stages, but the passage of steamboats was difficult and dangerous on account of leaning timber and numerous snags, logs, stumps, etc., in the channel.

The project adopted March 3, 1881, contemplated removing obstructions in Tensas River from its mouth to Dallas, La., 138 miles. Bayou Maçon, the chief commercial branch of Tensas River, was added under the same head of appropriation by river and harbor act of 1884, and the project contemplated the same kind of work from its mouth to Floyd, La., 112 miles.

The total expenditures to June 30, 1908, were $54,587.01. The project for Tensas River was completed in 1898 to Westwood Place, 81 miles above the mouth, the present head of navigation, at a cost of

[a] See consolidated money statement on page 496.

$11,947.02, and the project for Bayou Maçon to Floyd was completed in 1899 at a cost of $23,915.42. Lane Ferry, about 20 miles above Floyd, is the head of navigation in Bayou Maçon. The sum of $18,724.57 has been expended for maintenance. The work put the two streams in fairly good navigable condition at medium and high stages. Upper Tensas River above Westwood Place practically is unnavigable by reason of leaning timber and obstructions in the channel, and there has been no recent effort to induce a resettlement of the abandoned plantations along its banks or to secure a continuance of the improvement to Dallas.

During the fiscal year ending June 30, 1908, work for maintenance was continued for fifteen days in November in the lower 9 miles of Tensas River. The quarter boat used struck a snag and sunk. After it was raised the stages were too high to resume work.

The commerce consists chiefly of shipments of cotton, cotton seed, staves, etc., and return freights of plantation supplies. In eighteen years it has ranged between a maximum of 29,957 tons in 1905 and a minimum of 2,649 tons in 1893, the average being 15,247 tons, valued at $590,925.

It is proposed to apply the available funds to maintenance, and the additional estimate for the fiscal year 1910 to the removal of obstructions, including snags, overhanging trees, drift, etc. This additional work is for maintenance and extension of benefits.

July 1, 1907, balance unexpended	$5,102.14
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,189.15
July 1, 1908, balance unexpended	3,912.99
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(*d*) *Bayous D'Arbonne and Corney, Louisiana.*—Before improvement navigation of these streams was difficult and dangerous on account of the leaning trees and the number of snags, stumps, etc., in the channel.

The project adopted July 5, 1884, contemplated removing the obstructions between the mouth of Bayou D'Arbonne and Stein Bluff on Bayou Corney, 40½ miles upstream. The river and harbor act of 1892 authorized an extension of work up Bayou Corney 16½ miles to Cobb Landing, and the act of 1894 provided $1,000 for removing obstructions in the Little D'Arbonne Branch.

The amount expended to June 30, 1908, was $23,974.95, and resulted in greater safety to navigation. The work practically was completed in 1896 at a cost of $18,000. Subsequent expenditures for maintenance have amounted to $4,974.95, and $1,000 was expended for improving Little D'Arbonne Branch.

During the fiscal year ending June 30, 1908, work for maintenance extended from Farmerville down Bayou D'Arbonne to its mouth, 43.7 miles, and placed that stretch in good navigable condition for the time.

[a] See consolidated money statement on page 496.

The commerce consists of shipments of cotton, cotton seed, etc., and return freights of plantation supplies. It varies considerably, and during twelve years ranged between a maximum of 36,272 tons in 1907 and a minimum of 682 tons in 1903, the average being 12,172 tons, valued at $340,875.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1910, and the balance unexpended July 1, 1908, will be applied to removal of obstructions, including snags, overhanging trees, drift, etc. This additional work is for maintenance and extension of benefits.

July 1, 1907, balance unexpended	$2,067.39
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,942.34
July 1, 1908, balance unexpended	125.05
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

A condensed history of the work performed in Bayou Bartholomew, Boeuf River, and Tensas River and Bayou Maçon will be found in the Report of the Chief of Engineers for 1896, pages 1601–1613, and of that performed in Bayous D'Arbonne and Corney in the Report of 1895, page 1914. Subsequent reports of the district officers refer only to the yearly operations.

An index to reports of examinations and surveys was published in the Report of the Chief of Engineers for 1904, page 391.

There is no record of freight rates on Bayou Bartholomew and works consolidated with it available for making a comparison of the effect of the improvement. In a general way it may be stated that the rates have been greatly reduced; in fact, the traffic is no longer sufficiently lucrative to support the class of boats formerly plying on this stream, but it is now carried by smaller boats. This is largely due, however, to the competition by the railroads, and now boats ply only where the river is the only shipping route.

CONSOLIDATED.

July 1, 1907, balance unexpended	$18,224.86
June 30, 1908, amount expended during fiscal year for maintenance of improvement	6,647.74
July 1, 1908, balance unexpended	11,577.12
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	15,000.00

(See Appendix W 3.)

4. Mouth of Yazoo River and harbor at Vicksburg, Miss.—The shifting bar at the former mouth of the Yazoo was the most serious obstruction to navigation of that river and its tributaries, a system comprising about 800 miles of navigable waterways. At low stages

[a] See consolidated money statement on this page.

steamboats were prevented from entering or leaving the river without lightering their cargoes across the bar, and it frequently happened that the outlet was entirely closed to navigation throughout the basiest season of the year.

Prior to 1876 the city of Vicksburg possessed the most commanding site and the finest harbor on the Mississippi River. There was deep water along the city front, and the entire width of the river was available for steamboats at all stages, with not less than 25 feet depth in any part of the harbor. The cut-off of April 27, 1876, and subsequent shoaling of the old channel from the river to the front of the city, practically destroyed the harbor, which became unnavigable except at high stages.

The original project for improving Vicksburg Harbor was entered upon under the river and harbor act of June 18, 1878. The first work consisted of revetting the rapidly caving bank at Delta Point, La., opposite Vicksburg, the continued recession of which was increasing the distance from the harbor to the river channel. The river and harbor act of August 2, 1882, placed the work under the Mississippi River Commission, and the revetment at Delta Point was continued until 1900. No work has been done since. Some caving has occurred above the upper end of the revetment, which is protected by a hard point, but there appears to be no immediate danger of flanking. The amount expended at Delta Point was $389,486.08.

When Vicksburg Harbor was placed under the Mississippi River Commission in 1882 a project was adopted for dredging a basin, 1,700 feet long by 300 feet wide in front of the city, with a canal 150 feet wide to connect it with the river. Dredging under this project amounted to 250,035 cubic yards in 1883, when discontinued. It was resumed in 1888, under a slightly modified project, and continued until 1893. During the latter period the dredging amounted to 1,729,994 cubic yards, making a total of 2,080,029 cubic yards of excavation. In 1888 pile dikes were built at the north end of the basin and along the west side of the canal, aggregating 6,800 feet in length. The expenditures for Vicksburg Harbor were $442,724.77, which, added to the amount expended at Delta Point, makes a total of $832,210.85. The improvement of Vicksburg Harbor was transferred to the Engineer Department under a provision of the river and harbor act of August 18, 1894.

The existing project, adopted by Congress in the river and harbor act of July 13, 1892, contemplated opening a new mouth or outlet for Yazoo River from its original mouth on Old River (9.8 miles above the former outlet to the Mississippi) through deep water down the wrong end of Old River, thence across a neck of low land between Old River and Lake Centennial and around the head of De Soto Island and down the east arm of Lake Centennial to the Mississippi River, entering it upon the channel side at Kleinston Landing.

Lake Centennial is the old bend of the Mississippi River cut-off in 1876, and De Soto Island, prior to the cut-off, was the Louisiana peninsula, around which the river flowed. The estimate of cost—$1,500,000—was revised in 1893 and reduced to $1,200,000.

The work was completed in 1905 at a cost of $1,179,210.87. Subsequent expenditures for maintenance amount to $12,944.42. The new outlet was opened in the spring of 1903; uninterrupted navigation of

Vicksburg Harbor has been maintained for four years, and the new mouth of Yazoo River has been open to boats of 6 feet draft at mean low water. The extreme range between high and low water at Vicksburg is 59 feet, but the usual variation is about 45.3 feet.

The chief features of this work were the purchase of 1,155.54 acres of land for right of way of the main cut from Old River to Lake Centennial; the clearing and grubbing of the entire route; the excavation by dredging of 6,229,281 cubic yards of earth in opening the new outlet, of which about 934,000 cubic yards was used for building a dam, above ordinary low water, across the west arm of Lake Centennial from mouth of the main cut to head of De Soto Island, and constructing a levee containing 429,677 cubic yards from mouth of the canal at Kleinston westward along West Pass bar (which separates the west arm of Lake Centennial from Mississippi River) to within about 4,500 feet of King Point.

The work performed during the fiscal year ending June 30, 1908, was for maintenance, principally for repairs and protection of the West Pass levee.

An additional expenditure of $40,000 is considered necessary for revetment of West Pass levee on the lake side, to protect it from wave wash, and to replace the present decaying wooden bulkheads, which can not be expected to last more than a year longer, and $4,000 is required for surveys.

The annual commerce of Yazoo River, its tributaries, and Vicksburg Harbor, as reported for seven years, varied between 222,792 and 441,765 tons, the estimated values of which ranged from $6,801,000 to $13,272,000 per annum. The average of the commerce was 321,594 tons per annum, and the average value, $8,753,650.

Maps of the work at Delta Point have been published in Annual Reports of the Chief of Engineers for 1883, 1884, 1888, 1889, 1893, and 1900. Maps of Vicksburg Harbor accompany the reports of 1878 (p. 644), 1883, 1884, 1888, 1890, and 1893. Maps showing work under the existing project for diverting the mouth of Yazoo River, etc., accompany the reports of 1893, 1894, 1901, and 1902. Fifteen photographs were printed in the report for 1900.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1910, will be applied to revetting West Pass levee on the lake side and to surveys. The additional work proposed is for maintenance.

July 1, 1907, balance unexpended	$11,839.06
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,994.35
July 1, 1908, balance unexpended	7,844.71
July 1, 1908, outstanding liabilities	652.46
July 1, 1908, balance available	7,192.25
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	44,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix W 4.)

5. *Yazoo, Tallahatchie, Coldwater, and Big Sunflower rivers, and Tchula Lake, Mississippi.*—These improvements were consolidated by

river and harbor act of June 13, 1902. The same kind of work is required in all, i. e., the removal of wrecks, snags, stumps, tree slides, sunken logs, leaning timber, etc., for maintenance of navigation.

(*a*) *Yazoo River.*—Before improvement the period of navigation was limited to high stages on which steamboats could pass the wrecks of gunboats, steamers, and raft sunk during the civil war. The channel was much obstructed also by snags, stumps, tree slides, leaning timber, etc.

The project entered upon March 3, 1873, contemplated removing obstructions to give ease and safety to navigation. Subsequent acts of Congress provided for continuing the improvement and for maintenance. There is no practical distinction between improvement and maintenance, as floods, sliding and caving banks, and the rapid growth of vegetation along alluvial streams of this kind constantly add obstructions and render a continuance of snagging operations necessary in the interest of safe and uninterrupted navigation.

The total expenditure to June 30, 1908 (including $110.46 derived from sales), was $372,051.28, which has resulted in safe and uninterrupted navigation from mouth to head of the river the year round for more than twenty years. Steamboats of 3½ feet draft navigate the river at mean low water without serious difficulty.

During the fiscal year ending June 30, 1908, snagging operations, etc., for maintenance, extended over the entire river. Work at Jeffersonville, Ind., under contract, for the construction of the new steel snag boat *Ben Humphreys* was completed, and the boat was delivered at Vicksburg May 30, 1908.

The range between high and low water at Yazoo City is 40.8 feet. It is proposed to apply the available funds to continuing work for maintenance of the improvement.

The estimated amount that can be profitably expended in the fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908, will be applied to removal of obstructions, including snags, overhanging trees, drift, etc., and the maintenance and operation of snag and dredge boats. This additional work is for maintenance and extension of benefits.

July 1, 1907, balance unexpended		$88,009.95
June 30, 1908, amount expended during fiscal year:		
For constructing snag boat	$11,472.11	
For maintenance of improvement	11,478.66	
		22,950.77
July 1, 1908, balance unexpended		65,059.18
July 1, 1908, outstanding liabilities		9,421.62
July 1, 1908, balance available		55,637.56
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

(*b*) *Tallahatchie and Coldwater rivers.*—Before improvement Tallahatchie River was navigable to Sharkey, about 65 miles above its mouth, for six months of the year, but passage was difficult and dan-

[a] See consolidated money statement on page 503.

gerous on account of the number of obstructions in the channel and along the banks, and the wreck of the ocean steamship *Star of the West*, sunk February, 1863, 8 miles above the mouth. Above Sharkey the growth of leaning timber was so dense and the channel so obstructed by snags, etc., that that part of the stream practically was unnavigable. The same conditions continued up the Coldwater River.

The project entered upon March 3, 1879, contemplated removing obstructions in Tallahatchie River from the head of Yazoo River to the mouth of Coldwater River and up the Coldwater about 80 miles to Yazoo Pass. Work in the Coldwater River was abandoned in 1881, but was resumed under a provision of the river and harbor act of March 3, 1905.

The amount expended to June 30, 1908 (including 4 cents, refundment of overpayment), was $79,088.15, and the work performed permits steamboats of 3 feet draft to run to Sharkey the year round and into Coldwater River at moderately high stages.

Marks, on Coldwater River, is considered the present head of navigation, and boats rarely run above that place.

During the fiscal year ending June 30, 1908, work for the removal of obstructions in Tallahatchie River was continued, from the mouth of Coldwater River downstream to Yazoo River, benefiting navigation materially.

Operations for maintenance will be continued with the available funds.

The estimated amount that can be profitably expended during the fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908, will be applied to the removal of obstructions, including snags, overhanging trees, drift, etc., and the maintenance and operation of snag and dredge boats. This additional work is for maintenance and extension of benefits.

July 1, 1907, balance unexpended	$5,523.24
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,111.35
July 1, 1908, balance unexpended	2,411.89
July 1, 1908, outstanding liabilities	173.35
July 1, 1908, balance available	2,238.54
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*c*) *Tallahatchie River above mouth of Coldwater River to Batesville.*—To comply with requirements of river and harbor acts of 1880, 1881, and 1882, a total expenditure of $10,000 was made to clear this stretch of obstructing trees, stumps, and snags, after which work was discontinued by the United States. Commerce was revived in 1904, and, after the worst obstructions had been removed by popular subscription, about 2,100 tons of stave and spoke billets and other freight, valued at $100,000, was transported by steamboat.

The project entered upon March 2, 1907, contemplates an expenditure of $2,000 a year for a series of years to put the river in such

[a] See consolidated money statement on page 503.

condition that boats plying the lower Tallahatchie can safely run to Batesville for five to seven months of the year. Eventually the cost of maintenance will be reduced to $1,000 per year.

The amount expended to June 30, 1908, was $13,824.89. The work was resumed in May, 1907, after a lapse of twenty-five years, and on June 30, 1907, was in progress at a point 7 miles below Batesville.

During the fiscal year ending June 30, 1908, work was continued downstream to the mouth of Coldwater River. The chief obstructions to navigation were removed and the stretch placed in fairly good navigable condition.

This work has proved heavier and more difficult than was anticipated and the sum of $5,000 is required during the fiscal year 1910.

The estimated amount that can be profitably expended during the fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908, will be applied to the removal of obstructions, including snags, overhanging trees, drift, etc., and the maintenance and operation of snag and dredge boats. This additional work is for maintenance and extension of benefits.

July 1, 1907, balance unexpended	$3,144.63
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,969.52
July 1, 1908, balance unexpended	175.11
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*d*) *Big Sunflower River.*—Before improvement this stream was navigable about six months of the year, but was obstructed by snags, sunken logs, sand bars, and shoals; navigation was impeded by leaning timber, and at many places the channel was so choked with obstructions and so narrow that it afforded passage for the smallest craft only.

The project entered upon March 3, 1879, contemplated the removal of obstructions between the mouth and Clarksdale, about 180 miles, and the building of inexpensive pile and brush wing dams to scour depths of about 40 inches at the bars. Prior to the building of the Mississippi River levees, and since, when crevasses in the levees occurred, this stream carried large quantities of overflow water and its section was increased thereby. In this enlarged bed the normal river at low stages now flows between secondary banks and, as a rule, the main banks are not overtopped by floods, except near the mouth, where the flood height is affected by backwater from the Mississippi.

On account of the changed conditions, the river and harbor act of March 2, 1907, placed the upper limit of improvement at the mouth of Hushpuckena River, about 30 miles below Clarksdale; authorized a continuation of the work of removing obstructions below that point, and an improvement of the lower section, below Baird, about 87 miles, with a view to obtaining a navigable depth of 3 feet by means of the closure of outlets and more extensive contraction works. The estimates of cost for work below Baird were $75,000 for the necessary

[a] See consolidated money statement on page 503.

closing dams, about $10,000 per year for five years for continuation of the open-river work, and $5,000 per year thereafter.

The amount expended to June 30, 1908, was $117,521.32. The cutting of leaning timber, removal of channel obstructions, and the building and renewal of wing dams at the bars maintained navigation in the lower 100 miles of river, and enabled boats of 30 inches draft to run to Woodburn, about 77 miles above the mouth, at mean low water. Faisonia, about 100 miles above the mouth, is considered the head of navigation.

During the fiscal year ending June 30, 1908, operations for maintenance continued during the period of low water, between the mouth of Big Sunflower River and the mouth of Hushpuckena River, the chief work having been performed between the mouth of Hushpuckena River and Herd Landing, about 80 miles below, a stretch where little had been done for years. A contract was entered into November 12 for closing the chutes in lower Big Sunflower River, requiring about 116,300 cubic yards of levee embankment, to be completed by December 31, 1908. About 6 per cent of this embankment had been built June 30, 1908.

It is proposed to apply the available funds to the purpose of closing outlets in the lower 30 miles and to a continuance of snagging operations and the building and repair of wing dams where required.

July 1, 1907, balance unexpended	$101,362.56
June 30, 1908, amount expended during fiscal year for maintenance of improvement	15,883.88
July 1, 1908, balance unexpended	85,478.68
July 1, 1908, outstanding liabilities	2,141.47
July 1, 1908, balance available	83,337.21
July 1, 1908, amount covered by uncompleted contracts	30,915.00

(*e*) *Tchula Lake.*—This is an arm of Yazoo River, about 60 miles long, and east of Honey Island, in Holmes County. Before improvement it was obstructed its entire length by a network of snags, heavy leaning timber, and a thick growth of brush along both banks.

The project adopted March 3, 1881, contemplated removal of the obstructions to prolong the navigable period and to permit light-draft steamboats to pass through the lake earlier in the cotton season.

The amount expended to June 30, 1908, was $28,709.35. The work was practically completed and the stream put in safe navigable condition in 1895 at an expenditure of $21,000. Since 1902 $7,709.35 has been expended for maintenance.

No work was done during the fiscal year ending June 30, 1908.

The available funds will be applied to continuing work for maintenance.

The estimated amount that can be profitably expended during the fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908, will be applied to the removal of obstructions, including snags, overhanging trees, drift, etc., and the maintenance and operation of snag and dredge boats. This additional work is for maintenance and extension of benefits.

July 1, 1907, balance unexpended	$4,290.65
July 1, 1908, balance unexpended	4,290.65
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

The chief shipments out of Yazoo River and tributaries are cotton, cotton seed, staves, timber, etc., with return freights of general merchandise and plantation supplies. The commerce of seventeen years ranges between 102,098 and 544,503 tons annually, with values estimated at $2,840,000 to $9,198,000, the average being 241,618 tons, valued at $5,521,130.

Freight rates on cotton by boat are about 50 per cent less than by rail; on cotton seed about 33⅓ per cent less. Live-stock shipments by boat cost about one-third of the railroad rates, and grain, flour, meal, and provisions shipped by boat cost about 50 per cent less than by rail. To inland points the railroad rates are largely in excess of boat rates for the same distance. Large quantities of timber are rafted which could not be reached by rail.

A résumé of the work performed in Yazoo, Tallahatchie, and Big Sunflower rivers is given in the Report of the Chief of Engineers for 1896, pages 1613, 1626, and 1630. Subsequent annual reports of the district officers give each year's operations only. A résumé of work in Coldwater River is given in the Report of the Chief of Engineers for 1885, page 1518.

An index to reports of examinations and surveys was published in the Report of the Chief of Engineers for 1904, page 397. Reports of examinations of Tallahatchie River above mouth of Coldwater to Batesville, and of Big Sunflower River, made in 1905, were printed in House Documents Nos. 147 and 667, Fifty-ninth Congress, first session.

CONSOLIDATED.

July 1, 1907, balance unexpended		$202,331.03
June 30, 1908, amount expended during fiscal year:		
For constructing snag boat	$11,472.11	
For maintenance of improvement	33,443.41	
		44,915.52
July 1, 1908, balance unexpended		157,415.51
July 1, 1908, outstanding liabilities		11,736.44
July 1, 1908, balance available		145,679.07
July 1, 1908, amount covered by uncompleted contracts		30,915.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		50,000.00

(See Appendix W 5.)

[a] See consolidated money statement on this page.

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination of Boyce Landing, on Red River, Louisiana.*—Report dated October 29, 1907, is printed in House Document No. 219, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. *Preliminary examination of Roebuck Lake, Mississippi, from its mouth to the railroad bridge at Itta Bena.*—Report dated October 8, 1907, is printed in House Document No. 811, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

3. *Preliminary examination with plan and estimate of cost of improvement of Steele and Washington bayous, Mississippi, and Lake Washington from mouth of Steele Bayou to Glen Allan.*—Reports dated December 31, 1907, and February 6, 1908, are printed in House Document No. 904, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $15,000 is presented.

4. *Preliminary examination with plan and estimate of cost of improvement of Bear Creek, Mississippi.*—Reports dated October 10, 1907, and April 4, 1908, are printed in House Document No. 908, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $3,000 is presented.

The local officer was also charged with the duty of making preliminary examination and survey of *Big Sunflower River, Mississippi, from near Baird to the mouth of the Hushpuckena River*, provided for in the river and harbor act of March 2, 1907, and reports thereon will be duly submitted when received.

IMPROVEMENT OF RIVERS AND HARBORS IN THE LITTLE ROCK, ARKANSAS, DISTRICT.

This district was in the charge of Capt. W. D. Connor, Corps of Engineers. Division engineer, Col. E. H. Ruffner, Corps of Engineers, to March 16, 1908, and Col W. H. Bixby, Corps of Engineers, since that date.

1. *Arkansas River, Arkansas.*—In its original condition the channel of the river was greatly obstructed by shifting sand bars and numerous snags in its lower reaches, and by gravel and rock shoals and some snags in its upper reaches. Navigation was difficult and uncertain at medium and low stages, and during periods of extreme low water was impossible.

Prior to act of Congress approved June 13, 1902, the work on this river was carried on under two general projects—one entitled "Removing obstructions in Arkansas River, Arkansas and Kansas," the other "Improving Arkansas River, Arkansas."

The original project for "Removing obstructions in Arkansas River, Arkansas and Kansas" (act July 3, 1832), was to remove snags and wrecks. Subsequently this project was enlarged to include re-

moving bars by wing dams, and many of the appropriations were made for this work in combination with other rivers. By act of March 3, 1879, Congress adopted an additional project—that of improving the river between Fort Smith, Ark., and Wichita, Kans., by removing the snags and rocks and constructing dams at some of the worst shoals. Later these projects were merged into one, making the project extend from the mouth of the river to Wichita. Under these projects there was expended to June 30, 1902, $968,256.81.

The original projects for "Improving Arkansas River, Arkansas," were local and had in view the permanent improvement of the river at Fort Smith, Van Buren, Dardanelle, and Pine Bluff. By act of August 11, 1888, Congress adopted a general project, namely:

> That the Secretary of War shall expend the appropriation under this head with reference to the final improvement of this river as contemplated in the Report of the Chief of Engineers for the year ending July first, eighteen hundred and eighty-five, and as authorized in the act for the improvement of rivers and harbors approved August fifth, eighteen hundred and eighty-six, and in House Executive Document Numbered Ninety, Forty-ninth Congress, first session, said methods to be applied as the Secretary of War may direct at such points between Wichita, Kansas, and the navigable mouth of the Arkansas River at its junction with the Mississippi River, as he may deem for the best interest of commerce.

The "said methods" referred to in the act were "to remove rock and gravel reefs by blasting and dredging, to contract the channel by dikes and dams, permeable or solid, of such construction as the local conditions require, and to hold the channel so obtained by revetment where necessary." The improvement authorized by the act covers 771 miles, while estimates have been rendered for 708 miles, thus making the estimated cost of the improvement under this project indefinite. Act of August 18, 1894, authorized the operation of snag boats under this head in addition to similar operations under the project "Removing obstructions in Arkansas River, Arkansas and Kansas." To the close of the fiscal year ending June 30, 1902, there had been expended under the general project for improving Arkansas River, Arkansas, $903,311.93 for original construction, $314,119.14 for maintenance, and $63,397.32 for operating snag boats, making the total amount $1,280,828.39.

Act of Congress approved June 13, 1902, merged these two general projects into one, which makes the existing project in substance: "The improvement of the river from its mouth to the head of navigation by snagging operations, by dredging operations, and by contraction works, holding the improved channel by revetment where necessary." No definite estimate of cost can be given.

The river and harbor act of March 2, 1907, made available for maintenance of this improvement amounts previously appropriated for work in vicinity of Redfork levee or set apart for dredging. The act provided also for an examination of the river to Muskogee, Ind. T., by a Board of Engineers, with a view to devising a plan for further improvement, and made a conditional appropriation for work at Pine Bluff, if deemed by the Board to be necessary in the interest of navigation. Funds from this appropriation will be applied to work in pursuance of the Board's recommendation, and report on the subject will be found on page 510 of this report under the heading "Arkansas River at Pine Bluff and White River at Augusta Narrows, Arkansas."

To June 30, 1908, there had been expended under the consolidated project for Arkansas River $178,837.32, of which $135,398.95 was for operating snag boats, $22,968.37 for operating a hydraulic dredge, and $20,470 for maintaining works of permanent improvement. The total expenditure under all projects to June 30, 1908, is $2,427,922.52, of which $1,167,053.08 is for operating snag boats, $22,968.37 for operating hydraulic dredge, $903,311.93 for original construction of works of permanent improvement, and $334,589.14 for maintenance of these works.

The works erected for the permanent improvement of the stream never gave full benefit to navigation, having been built in disconnected reaches and having finally been abandoned before the project was completed. After expending $1,237,901.07 in the construction and maintenance of these works, the permanent improvement of the stream was abandoned. Snagging operations have improved the channel in the permanent reaches; in other localities the improvement has been temporary and must be repeated from time to time.

Fort Gibson, on Grand River, 2 miles above its mouth and 463 miles from the mouth of the Arkansas River, is the head of steamboat navigation. The duration of the navigable periods of the river varies greatly in different years. Occasionally there are periods of very low water, when navigation will be suspended throughout the length of river, and then there will be times when it is possible to maintain 3-foot navigation through to Fort Gibson all the year. The navigation periods are of about the following averages:

	Months a year for 4-foot draft.	Months a year for 2-foot draft.
Mouth to Swan Lake (80 miles)	5½	10
Mouth to Little Rock (174 miles)	5	9½
Mouth to Grand River (461 miles)	4	8

The maximum draft that can be carried all the year round varies from as much as 16 inches in the section between Fort Smith and Webbers Falls (369 to 430 miles above the mouth), and 24 inches in the section between Fort Smith and the mouth, during the fiscal year 1899 to as little as 11 inches at Silver Lake and Pendleton, only 42 miles above the mouth, with the extreme low stage continuing from November 6 to December 19, 1897, Little Rock gauge 1.2 to 1.8.

The range between extreme high water and extreme low water at Fort Smith, Ark., is 35.5 feet; at Little Rock, Ark., 28.5 feet, and at the mouth of the river where the stages are controlled by those of the Mississippi the extreme range is 53.7 feet.

The operations of this fiscal year consisted in operating the snag boats *Arkansas* and *C. B. Reese* and the hydraulic dredge *Gamma*. The snag boats removed 2,314 snags from the channel, cut 7,995 trees on caving banks, and broke up 5 drifts. The dredge *Gamma* worked on Silver Lake bar (43 miles above the mouth) and Sandy Bayou Crossing (20 miles above the mouth) during July, 1907, and considerably improved the depths at the latter point. In the spring of 1908, the dredge *Gamma* was again loaned to this district, but owing to high water no dredging was undertaken until June 29, 1908, and the dredge is now working on Rob Roy Crossing, 99 miles above the mouth. On account of conducting the dredging operations with plant

borrowed from the Mississippi River Commission, which has to be returned to Memphis at a certain time (generally August 1), much of the dredging is done at higher stages than that at which the best and most lasting work is accomplished, and much better results could be obtained by the use of a plant that could carry on dredging operations during the actual low-water season, which rarely begins before August. Experimental dredging is being continued through the present low-water season and at the end of that time it is thought that definite recommendations can be made in regard to future dredging operations in this river.

A new boat, the *Border City*, entered the trade between Fort Smith (369) and Webbers Falls (430) March 18, 1908, and the owner reports nothing less that 2½ feet channel depth since that date. The Muskogee-Oklahoma Packet Company has been organized with a view to entering the trade between Fort Smith (369) and Muskogee (460, mouth of Grand River), and at the writing of this report their new boat, the *City of Muskogee*, is leaving Jeffersonville, Ind., for Muskogee. The steamer *Mary D.*, which formerly operated in the above trade, has confined its business during the past year to the local trade between Muskogee Landing (460), on the Arkansas River, and points a short distance up Grand River.

The river was at a comparatively good boating stage all the year.

The balance available July 1, 1908, will be expended in operating snag boats and in continuing hydraulic dredging, and the additional appropriation asked for in maintenance of the channel by snagging operations.

Information as to the effect of the improvement on freight rates is meager, but indicates that a material reduction has resulted.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1894	63,563	$2,846,395	1902	40,557	$1,630,297
1895	50,498	2,380,420	1903	86,068	2,389,020
1896	54,261	2,408,720	1904	92,011	2,078,898
1897	66,077	1,657,218	1905	86,458	1,636,930
1898	58,578	1,626,756	1906	103,214	1,512,719
1899	68,057	2,470,131	1907	104,593	2,190,531
1900	75,654	2,078,940	1908	103,919	2,150,269
1901	71,998	2,623,797			

The commerce was made up of plantation products and supplies, cooperage stuff, lumber, and saw logs, the latter making 61 per cent of it, but representing less than 8 per cent of its total value.

Reference to the principal examinations and surveys is given on page 401 of the Annual Report for 1904.

July 1, 1907, balance unexpended	$96,751.25
Refundment of overpayments	11.80
	96,763.05
June 30, 1908, amount expended during fiscal year for maintenance of improvement	43,365.20
July 1, 1908, balance unexpended	53,397.85
July 1, 1908, outstanding liabilities	13,678.12
July 1, 1908, balance available	39,719.73

Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	$73,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix X 1.)

2. White River, Arkansas.—In its original condition this river was much choked by logs, snags, and drift in its lower reaches, and in its upper reaches—i. e., above Jacksonport—by gravel shoals, bowlders, and some snags.

The original project (act of March 3, 1871) was to remove snags and similar obstructions, the work being combined with similar work on Black and Little Red rivers. Act of June 23, 1874, extended the improvement to Forsyth, Mo., the project being to remove snags and bowlders and to contract the water width at shoals. During the period 1873–1884 the snagging operations on the lower river were in connection with similar work on St. Francis River, while the improvement above Jacksonport was under appropriations confined to that portion of the stream. The act of July 5, 1884, was the first independent appropriation for the river as a whole. It readopted and consolidated into one the separate projects and provided for a survey with a view to the permanent improvement of the river from Forsyth, Mo., to the mouth. The project of 1888 (Annual Report of the Chief of Engineers for 1888, p. 1406) was to deepen the water on shoals by contracting the channel, and to remove rocks, bowlders, and snags from the channel, the object being to obtain a channel 5 feet deep at low water from the mouth to Newport and 2 feet deep thence to Buffalo shoals, at an estimated cost of $105,815, with an additional amount of $8,000 a year for two or three years for snagging. For reasons given in the Annual Report of the Chief of Engineers for 1891, page 2049, the estimates were inadequate to accomplish the object. The act of July 13, 1892, appropriated $53,815 to complete the project, and an additional sum of $21,185 to be expended "in the discretion of the Secretary of War." These funds and those appropriated since have been expended on the lines of the project of 1888, with the addition of dredging on the shoals. The act of March 3, 1899, adopted a lock-and-dam project for the improvement of this river above Batesville, thus reducing the scope of the former project to improving the river from the mouth to Batesville by contracting the channel, by removing rocks, bowlders, and snags, and by dredging.

It is not practicable to state the expenditures on this river when the work was carried on in connection with other rivers. From the separate appropriations for the whole river, or for reaches of it, to the close of the fiscal year ending June 30, 1908, there has been expended $440,895.33. Of this amount $4,000 was allotted to Cache River, $11,061.46 was spent on special works at Batesville, $166,000 was on projects prior to that of 1888, $108,815 was for original construction under the project of 1888, and $150,704.03 on maintenance of works and on snagging and dredging, and $314.84 on prevention of cut-off at Augusta Narrows near Augusta, Ark.

In a few instances the contraction works above Jacksonport gave a slight increase in channel depth, but, on the whole, there was not enough improvement in the channel to be of any material benefit to navigation; the dredging between Jacksonport and Batesville in fiscal year 1898 made a channel 3 feet deep during one low-water season, but the dredging has not been continued, no plant being available; the snagging operations make the natural depths of the stream available during the low-water season in which the snagging is done. The winter and the spring floods following bring other obstructions into the stream; hence snagging operations are needed every year.

Forsyth, Mo. (505 miles above the mouth), is the head of steamboat navigation. From its mouth to Jacksonport, 264 miles, the river is generally spoken of as being navigable at any time for boats of not over 3-foot draft. Between Jacksonport and Batesville, where Lock No. 1 of the upper White River improvement is located, the low-water channel depths are approximately 16 inches.

The range between extreme high water and extreme low water below Dam No. 1 at Batesville is 35.5 feet; at Jacksonport, 34.4 feet; at Clarendon, 32.5 feet, and at the mouth of the river 53.7 feet.

On page 1668 of the Annual Report of the Chief of Engineers for 1896 there is given the location of all the principal works built for the improvement of this river. Report of survey from Forsyth, Mo., to the mouth, with plans for improvement, is given in the Annual Report of the Chief of Engineers for 1888, page 1406.

The snagging operations this fiscal year consisted in operating the snag boat *Quapaw* six weeks and the snag boat *C. B. Reese* two months, the work extending from Black Island (266) to the mouth of the cut-off (8). By these operations 567 snags were moved from the channel, 951 trees cut from caving banks, and 4 drifts were broken up.

The river was at a comparatively good boating stage all the year.

The amount now available and the amount estimated as being needed during the fiscal year ending June 30, 1910, will be applied to maintenance and operation of snag boats.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1895	73,759	$2,494,377	1902	184,066	$1,212,438
1896	74,882	2,056,991	1903	140,013	882,225
1897	73,962	2,435,814	1904	193,498	1,021,778
1898	102,337	1,415,013	1905	134,588	770,689
1899	117,891	1,619,351	1906	100,083	766,138
1900	134,696	2,244,222	1907	127,812	830,659
1901	148,574	1,700,355	1908	161,246	962,508

Complete tonnage report was not received, but lumbering and kindred industries make up the steamboat commerce. Thirty-three per cent of the tonnage reported this year was rafted saw logs and rafted railway ties floated with the current.

Information as to the effect of the improvement on freight rates is meager, but indicates that a material reduction has resulted.

July 1, 1907, balance unexpended	$28,940.75
Refundment of overpayment	.10
	28,940.85
June 30, 1908, amount expended during fiscal year for maintenance of improvement	10,908.98
July 1, 1908, balance unexpended	18,031.87
July 1, 1908, outstanding liabilities	783.39
July 1, 1908, balance available	17,248.48
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	16,000.00

(See Appendix X 2.)

3. Arkansas River at Pine Bluff and White River at Augusta Narrows, Arkansas.—Statement of original condition of river, range and floods, commercial statistics, etc., will be found in reports for improving Arkansas River, Arkansas, and for improving White River, Arkansas.

The Board of Engineers appointed pursuant to requirement of the river and harbor act of March 2, 1907, recommended, under date of May 27, 1907, that certain work be done at Pine Bluff on Arkansas River, and at Augusta Narrows on White River. On August 14, 1907, a project was submitted for work at both places, under which $50,000 is to be expended at Pine Bluff, $28,500 at Augusta Narrows, and the balance of $100,000 conditionally appropriated by act of March 2, 1907 ($21,500), to be reserved for repairs or further work that may be found necessary at these points.

At Pine Bluff a levee containing about 248,000 cubic yards is to be built, and a contract for same was let January 4, 1908, but the titles to the lands required for right of way have not yet been approved.

At Augusta Narrows the project contemplates the construction of a levee and revetment, and the operations during this fiscal year consisted in constructing, approximately, 80 per cent of the levee work and in placing the mattress for the revetment and unloading the necessary stone from cars.

The balance on hand July 1, 1908, with the exception of the $21,500 reserved, will be applied to completing the work as outlined in the project.

July 1, 1907, balance unexpended	$100,000.00
Refundment of overpayment	1.00
	100,001.00
June 30, 1908, amount expended during fiscal year for works of improvement	19,410.68
July 1, 1908, balance unexpended	80,590.32
July 1, 1908, outstanding liabilities	1,770.91
July 1, 1908, balance available	78,819.41
July 1, 1908, amount covered by uncompleted contracts	52,276.77

(See Appendix X 3.)

4. Upper White River, Arkansas.—Earlier works on this portion of White River were made under appropriations for improving White River, Arkansas, and have been fully reported upon under that head.

The original condition of the river and previous projects for its improvement are also reported there.

The existing project, adopted March 3, 1899, is based on a report printed in the Annual Report of the Chief of Engineers for 1897, page 1992, and is to provide slack-water navigation from Batesville, Ark., to Buffalo shoals, 89 miles, by 10 fixed dams with concrete locks. The locks are to be 175 feet between hollow quoins and 36 feet wide, with a depth of about 4 feet on the lower miter sills. The estimated cost is there given as $1,600,000 for the 10 locks and dams.

A Board of Engineers appointed pursuant to requirement of the river and harbor act of March 3, 1905, to consider this project, has submitted its report and reference thereto will be found on page 460 of the report for 1906.

To the close of the fiscal year ending June 30, 1908, there had been expended on this work $809,141.65. Three locks and dams have been completed and are operated under the indefinite appropriation "Operating and care of canals and other works of navigation." By the operations of this fiscal year, Lock and Dam No. 3 has been completed, being placed under the indefinite appropriation above referred to, February 1, 1908. The total allotments and appropriations for Lock and Dam No. 3, was $233,925, and total expenditures to date are $232,264.15, with estimated outstanding liabilities of $1,567.25.

Forsyth, Mo., 204 miles above Batesville, is the head of steamboat navigation. The channel depths over the shoals in the unimproved part of the river are small, being only 8 to 10 inches during lowest waters. The range between high and low water at Buffalo City, the head of this project, is about 45 feet. Below Dam No. 1, at Batesville, this range is 35.5 feet.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1899	9,059	$548,335	1904	15,655	$53,942
1900	39,253	1,260,716	1905	12,496	42,736
1901	23,522	639,855	1906	11,188	61,819
1902	27,472	758,040	1907	14,235	85,156
1903	16,315	737,080	1908	34,614	159,474

Railway ties and saw logs made up 74 per cent of the tonnage and two-thirds of the value of all commerce reported. The *G. W. Huff*, with 3 barges, entered the trade above Batesville during this fiscal year, being engaged principally in handling cooperage materials.

The Batesville Board of Trade reports that the work done has resulted in making Batesville a "common" point, but definite information as to the effect of the improvement on freight rates has not been obtained.

July 1, 1907, balance unexpended	$80,888.98
Refundment of overpayments, unclaimed wages, and receipt from sales	281.45
	81,170.43
June 30, 1908, amount expended during fiscal year for works of improvement	[a] 76,528.79
July 1, 1908, balance unexpended	[b] 4,641.64
July 1, 1908, outstanding liabilities	1,865.50
July 1, 1908, balance available	2,776.14

(See Appendix X 4.)

5. *Operating and care of Locks and Dams Nos. 1, 2, and 3, upper White River, Arkansas.*—These locks and dams were built with funds derived from appropriations for improving upper White River, Arkansas. The available length of the locks is 147 feet, available width is 35 feet, and depth over the miter sills at normal pool levels is 5 feet. Lock and Dam No. 1 was placed under this appropriation on January 16, 1904; Lock and Dam No. 2, on February 16, 1905, and Lock and Dam No. 3, on February 1, 1908.

The high-water mark of May, 1898 (before the dams were built), is 22 feet above the crest of Dam No. 1 and 18.4 feet above the crest of Dam No. 2. The highest stages reached by the river since the dams have been completed were 20 feet above the crest of Dam No. 1 and 18.2 feet above the crest of Dam No. 2, on May 8, 1907. Since the completion of Dam No. 3 there has been no extreme high water in the upper river. The lowest stages this fiscal year were 0.4 above the crest of Dam No. 1 and 0.3 above the crest of Dam No. 2, December 18, 1907, the low stage being due to the construction of Dam No. 3. The expenditures during this year were for ordinary operating expenses of the locks, for repairs to high-water damages done by the high water of May, 1907, and for the completion of quarter boat and care and repair of floating plant.

The total amount expended under this head to June 30, 1908, is $114,670.64, of which $43,068.75 was expended this fiscal year.

Commercial statistics, year ending May 31.

Year.	Lock No. 1.		Lock No. 2.		Lock No. 3.		Open river.
	Lockages.	Freights.	Lockages.	Freights.	Lockages.	Freights.	Freights that did not pass through a lock.
	Number.	*Tons.*	*Number.*	*Tons.*	*Number.*	*Tons.*	*Tons.*
1904	[c] 115	8,320	.....	.....	.....	.....	7,335
1905	244	8,771	[d] 60	4,165	.....	.....	5,000
1906	246	7,306	183	8,692	.....	.....	2,196
1907	191	6,798	263	9,431	.....	.....	1,283
1908	249	13,746	661	22,077	[e] 126	4,337	7,533

[a] Lock and Dam No. 3.
[b] Lock No. 1, $214.50; Lock No. 2, $2,766.29; Lock No. 3, $1,660.85.
[c] Four months.
[d] Three and a half months.
[e] Five months.

(See Appendix X 5.)

6. Cache River, Arkansas.—In its original condition this river was much obstructed by snags, drift, and overhanging timber. The low-water depth on the controlling shoals was 6 to 8 inches.

The original project, adopted by the act of August 11, 1888, was to remove logs, snags, and overhanging timber from the mouth to Riverside (102 miles). The amount expended on this project was $9,000.

Acts of August 18, 1894, and June 3, 1896, each authorized the Secretary of War to expend $2,000 of the White River appropriation on this stream. These funds were expended in snagging operations from the mouth of the river to James Ferry, 79 miles, in accordance with a project adopted in 1888. Acts of March 3, 1899, and June 13, 1902, made independent appropriations for this stream. These were expended in snagging operations between the mouth of the river and James Ferry along the lines of the 1888 project, under which there has been expended $9,000 to June 30, 1908, the entire expenditure being for maintenance of channel. The operations prior to fiscal year 1904 were of material benefit to commerce, by lengthening the navigable period and rendering the natural depths of the stream available for navigation purposes. The small amount of work done in fiscal year 1906 was not sufficient to restore the river to the condition that existed when work ceased in the autumn of 1902. The funds on hand not being sufficient to purchase the necessary outfit and conduct the operations necessary to give relief, no work has been done during this fiscal year, it being thought advisable to defer operations until September, 1908, when plant and outfit will be available from other works.

Gray's bridge, 95 miles above the mouth of the river, is considered the head of steamboat navigation, but the river is not navigable to that point all the year, the ruling depth in the channels over the shoals throughout the river being only 8 to 10 inches during lowest water. During high-water seasons rafts are run from 100 or more miles above Gray's bridge. In the vicinity of James Ferry (79 miles above the mouth of the river and the upper limit of snagging operations now) the range between high and low water is about 15 feet. Because of backwater from White River this range is increased to 24 feet at Rock Island Railway bridge and to 32 feet at the mouth of the river.

Reports of the more recent preliminary examinations of this river are given in the Annual Report of the Chief of Engineers for 1887, page 1547, and in the Annual Report of the Chief of Engineers for 1895, page 2037.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1895	12,603	$25,494	1902	15,676	$40,301
1896	20,748	62,483	1903	16,843	109,681
1897	34,990	108,460	1904	15,865	49,601
1898	10,193	36,635	1905	11,660	29,860
1899	7,667	52,936	1906	10,942	31,777
1900	11,215	29,961	1907	13,050	39,225
1901	10,374	30,100	1908	21,173	59,254

The tonnage reported for this fiscal year was made up entirely of rafted railway ties and saw logs floated with the current.

The balance unexpended July 1, 1908, and the additional appropriation asked for will be expended in snagging operations below James Ferry.

July 1, 1907, balance unexpended	$2,000.00
July 1, 1908, balance unexpended	2,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	3,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix X 6.)

7. *Black and Current rivers, Arkansas and Missouri.*—Prior to fiscal year 1905 the work on these rivers was provided for under separate appropriation titles. The works were consolidated by river and harbor act of March 3, 1905.

(*a*) *Black River.*—In its original condition this river below the mouth of Current River had, at ordinary low water, a controlling depth of 2 to 2½ feet on the shoals, but this was not available on account of snags and similar obstructions. Above the mouth of Current River navigation was practically impossible at ordinary low stages, and no rafting was possible above the Arkansas and Missouri State line.

The original project, adopted by act of June 14, 1880, contemplated removing logs, etc., cutting down shoals by means of wing dams, and closing some of the most troublesome sloughs. The estimated cost was $80,800. The only modification of the project has been that of changing the estimate to $8,000 a year for maintenance. The district officer recommends that this be increased to $18,000 for the two streams.

To June 30, 1908, there had been expended on this work $160,717.08.

Poplar Bluff, Mo., 239 miles above the mouth of the river, is the head of navigation. All-the-year navigation has been made possible to this place for boats of not over 18 inches draft. Boats of not over 2½ feet draft can navigate this river below the mouth of Current River, 116 miles, during the lowest waters, and this portion of the river is generally spoken of as being navigable for 3-foot boats at any time.

The range between high and low water at Poplar Bluff is 19 feet. This difference decreases below Poplar Bluff, and in the flat lands to the southward it averages about half of this, being 8.5 feet at Corning bridge, 70 miles below Poplar Bluff. After passing to below head of Little River the difference between high and low water increases, and at Pocahontas, 129 miles below Poplar Bluff, the difference is 26.5 feet, and at the mouth of the river it is 34.4 feet.

The operations during this fiscal year consisted in snagging operations carried on by the hand-propelled snag boat *Riverside* and the snag boat *Quapaw*, the former working the river above the mouth of Current River and the latter below that point. During the year the boats removed 1,596 snags from the channel, cut 2,870 trees from the

banks, and broke up 29 drifts. The river was at a fair boating stage all the year.

The report of the examination upon which the present project for the improvement of Black River is based is given in the Annual Report of the Chief of Engineers for 1880, page 1326.

(*b*) *Current River.*—The original condition of this stream was such that no steamboat navigation above the mouth of Little Black River was attempted except when the river was at high stages. Below Little Black River navigation was suspended when the river was below medium stage. The natural depths were not available on account of snags and leaning trees.

Although the United States made some improvements to this stream in 1873, and again in 1882 and 1883, the regular improvement of it was not undertaken until act of Congress of August 18, 1894, adopted a project for its improvement from Van Buren, Mo., to the mouth by snagging operations and by contracting the channel at the worst shoals by wing dams, at an estimated cost of $10,000. The appropriation of June 3, 1896, completed the amount originally estimated for the completion of the project, and all operations since then have been under estimates for maintenance. No wing dams have been built, all operations having been confined to snagging.

To June 30, 1908, there has been expended on this river $39,868.84, $7,000 of which was in the early work mentioned above, leaving $32,868.84 as the amount expended on the existing project. Of this latter amount, $22,868.84 was for maintenance.

Reference to the preliminary examination of this stream and to a subsequent examination of it is given on page 408 of Annual Report for 1904.

Van Buren, Mo., 94.5 miles above the mouth of the river, was taken as the head of navigation when the earlier projects for this river were adopted. Small gasoline boats occasionally ply the river that far up, and rafts are run over the entire river, but Pitmans Landing, near the State line between Arkansas and Missouri and 41 miles above the mouth of the river, is generally spoken of as the head of steamboat navigation. Boats can not reach that point, however, during low-water seasons, the low-water depths of the river being as follows: Three feet from the mouth to Blunts (Johnsons Landing), 25 miles; 2 feet from Blunts to mouth of Little Black River, 7 miles, and 16 inches from mouth of Little Black River to Pitmans Landing, 9 miles. From Pitmans Landing to Doniphan, 12 miles, the head of the work done by snag boats now, the low-water depths are about 12 inches.

The range between high and low water at Van Buren is about 16 feet, and this range does not vary much until below the mouth of Little Black River, when the range increases to 19 feet.

During this fiscal year the snag boat *Quapaw* worked in this river from its mouth up to the mouth of Little Black, and the hand-propelled snag boat *Riverside* worked over the lower 68 miles of the river. Altogether, the boats removed from the channel 619 snags and cut 939 trees. The river was at a fair boating stage all the year.

Commercial statistics.

Year ending May 31—	Black River.		Current River.	
	Value.	Tons.	Value.	Tons.
1895	$1,085,415	132,433	$362,447	31,205
1896	891,437	111,278	227,291	29,867
1897	1,704,799	111,611	581,528	17,078
1898	788,640	115,612	306,216	52,417
1899	529,336	83,404	239,869	43,050
1900	966,961	129,698	578,834	65,043
1901	989,635	185,714	234,555	64,102
1902	919,767	166,213	165,766	37,185
1903	695,649	138,181	142,899	45,309
1904	1,092,648	191,285	139,119	55,573
1905	1,004,299	144,065	409,297	74,048
1906	625,985	139,384	152,216	47,704
1907	692,968	107,914	226,655	48,486
1908	517,905	140,826	115,398	27,696

Logging and kindred industries furnish the bulk of the steamboat commerce. Of the commerce reported this fiscal year 28 per cent of that on Black River and 93 per cent of that on Current River was rafted saw logs, railway ties, and lumber. Full report was not received from small boats operating in the upper portions of both rivers.

The funds now available and the amount estimated as being needed for the fiscal year ending June 30, 1910, will be applied to operating and maintaining snag boats.

BLACK RIVER.

July 1, 1907, balance unexpended	$12,343.15
June 30, 1908, amount expended during fiscal year for maintenance of improvement	6,322.73
July 1, 1908, balance unexpended	6,020.42
July 1, 1908, outstanding liabilities	230.73
July 1, 1908, balance available	5,789.69
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

CURRENT RIVER.

July 1, 1907, balance unexpended	$5,029.15
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,062.99
July 1, 1908, balance unexpended	1,966.16
July 1, 1908, outstanding liabilities	64.00
July 1, 1908, balance available	1,902.16
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

[a] See consolidated money statement on page 517.

CONSOLIDATED.

July 1, 1907, balance unexpended	$17,372.30
June 30, 1908, amount expended during fiscal year for maintenance of improvement	9,385.72
July 1, 1908, balance unexpended	7,986.58
July 1, 1908, outstanding liabilities	294.73
July 1, 1908, balance available	7,691.85
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	18,000.00

(See Appendix X 7.)

8. *St. Francis and L'Anguille rivers, Arkansas.*—(*a*) *St. Francis River.*—In its original condition this stream was not navigable above Lesters Landing at any stage; between Lesters Landing and Marked Tree navigation was possible at high stages only, and below Marked Tree it was difficult at medium and lower stages and impossible at extreme low water.

The original project, adopted by act of March 3, 1871, contemplated improvement from the mouth to Wittsburg by snagging operations. For the period 1873–1882 the appropriations were made for this work in connection with White River, Arkansas. By act of June 14, 1880, appropriation was made for improving the river from Wittsburg to Lesters Landing, the project for the expenditure of this appropriation being to cut a channel through "The Lake" and clear the river of obstructions by snagging operations. Appropriation made by act of July 5, 1884, was the first separate appropriation for the entire river. The act did not state the limits within which it was to be applied. Under it snagging operations were carried on to the town of St. Francis, Ark., and several of the sloughs or side channels were closed. When the improvement of St. Francis River, Missouri, was begun (act of August 11, 1888), Kennett, Mo., was taken for the upper limit of this work, making the existing project—

removal of logs, drifts, and snags from the channel, and overhanging timber from the banks from the mouth to Kennett, Mo., and closing the chutes and sloughs in the Sunk Lands, so as to make the river navigable at high stages to Kennett, Mo., at medium stages to Marked Tree, and at low stages to a point 80 miles below Madison, Ark., the estimated cost being $8,000 annually.

(*b*) *L'Anguille River.*—By acts of June 18, 1878, March 3, 1879, and June 14, 1880, a total of $17,000 was appropriated for snagging operations on L'Anguille River to Marianna. This was finally expended in fiscal year ending June 30, 1887. Act of June 13, 1902, revived this work and included it with St. Francis River.

There has been expended on these rivers to June 30, 1908, $108,459.22. This amount, however, does not include the expenditures on St. Francis River while it was combined with White River, as said expenditures can not be determined.

By the early operations the St. Francis River between Wittsburg and Lesters Landing was improved to such an extent that boats could reach the latter-named place on the same stage as they could the former. By subsequent operations the period of navigation below

Wittsburg was lengthened about two months, and above Lesters Landing a fair high-water channel was made. The improvements thus made below Wittsburg have been maintained. No effort is being made to maintain those above Marked Tree, the commerce in that portion of the river not warranting any expenditures at this time. During periods of low water neither stream is navigable, there not being sufficient depth of water over the shoals. Marianna is the head of navigation on L'Anguille River. The head of navigation on St. Francis River is near Wappapello, Mo., about 100 miles above Kennett, Mo., the upper limit of the portion of the river covered by this project. Lying between Kennett, Mo., and Foot of Lake, 80 miles below, are the Sunken Lands of the St. Francis, one vast swamp, through which the river flows in several channels, none of which is well defined and all of which are more or less obstructed and frequently blocked. Lesters Landing is 34 miles above Foot of Lake and is the practicable head of navigation on the St. Francis River in Arkansas. Boats can pass between it and Kennett, Mo., only during high stages, and then only with great difficulty.

The range between high and low water of St. Francis River at Lesters Landing is about 3 feet. This increases to 16 feet at Marked Tree, and this range is probably the maximum that would exist at any point below there were it not for the backwater from the Mississippi River. At Madison the extreme range is about 33 feet, and at the mouth of the river it is about 55 feet.

Reference to examination and survey of these rivers with a view to improvement by means of locks and dams is given on page 410 of Annual Report for 1904. Reference to report of examination of St. Francis River from its mouth to St. Francis, Ark., will be found on page 460 of Annual Report for 1906.

During the year the snag boat *A. B. Johnson* worked from the mouth of St. Francis River to the mouth of Tyronza River, removing 776 snags, cutting 4,103 trees, and breaking up 31 drifts.

Commercial statistics, year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1894	19,763	$98,375	1902	85,831	$269,190
1895	3[illegible],107	321,439	1903	88,035	294,495
1896	67,740	401,457	1904	119,172	423,469
1897	97,348	1,117,891	1905	142,098	590,560
1898	23,819	237,481	1906	137,319	472,257
1899	27,892	315,459	1907	151,015	833,397
1900	45,065	194,237	1908	286,820	1,376,757
1901	57,102	272,609			

Saw logs and rough lumber made up 97 per cent of the tonnage reported this year, and 33 per cent of the tonnage was saw logs floated with the current.

The balance available July 1, 1908, will be expended in maintenance of the channel by snagging operations. The amount estimated as needed during the fiscal year ending June 30, 1910, is for snagging operations.

July 1, 1907, balance unexpended	$12,152.26
June 30, 1908, amount expended during fiscal year for maintenance of improvement	5,374.29
July 1, 1908, balance unexpended	6,777.97
July 1, 1908, outstanding liabilities	133.85
July 1, 1908, balance available	6,644.12
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	9,000.00

(See Appendix X 8.)

EXAMINATIONS REQUIRED BY RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Pursuant to a requirement in section one of the river and harbor act of March 2, 1907, a Board of Engineers has been appointed to make an examination of *Arkansas River to Muscogee, Indian Territory, with a view to ascertaining whether any feasible or desirable plan can be devised for the improvement of the whole of said river to Muscogee or any portion thereof.* The Board's report will be duly submitted.

The Board was also charged with the duty of investigating conditions on the *Arkansas River at Pine Bluff and White River at Augusta Narrows*, required by the river and harbor act of March 2, 1907, and has reported that the protection of the banks and rectification of the river at the points named is directly and necessarily required in the interest of navigation. This report will be duly submitted with the Board's report on examination of the Arkansas.

The local officer was also charged with the duty of making preliminary examination and survey of *Saline River, Arkansas*, provided for in the river and harbor act of March 2, 1907, and reports thereon will be duly submitted when received.

IMPROVEMENT OF RIVERS AND HARBORS IN THE ST. LOUIS, MISSOURI, DISTRICT.

This district was in the charge of Col. Clinton B. Sears, Corps of Engineers, to January 28, 1908, and in the temporary charge of Capt. G. R. Lukesh, Corps of Engineers, since that date. Division engineer, Col. W. H. Bixby, Corps of Engineers, since February 15, 1908.

1. Removing snags and wrecks from the Mississippi River below the mouth of the Missouri River.—Before this work was originally begun the navigation of the river was seriously obstructed by numerous snags, logs, etc., which had lodged in the channel, and to which additions were made with each rise of the river. A large number of wrecked flatboats, barges, steamboats, and other river craft also obstructed the navigable channels, menacing life and property.

For the removal of these obstructions appropriations were made as early as 1824. The project adopted consisted of building boats suitable for removing snags, logs, drift heaps, wrecks, etc., and operating them whenever the stage of river was favorable and funds were avail-

able, and in cutting trees from caving banks to prevent their falling into the river and becoming obstructions to navigation.

The existing project is a continuation of the plan adopted in 1879, when the first specific appropriation for removing snags, wrecks, etc., from the Mississippi River was made by the river and harbor act approved March 3, 1879. Specific appropriations or allotments were made for this work each year thereafter, except 1883, 1885, and 1887, but in 1888, by section 7 of the river and harbor act of August 11, 1888, a continuous annual expenditure of $100,000, or as much thereof as might be necessary, was authorized for the maintenance of this service, and this amount has been available each year since to the present time.

No modification of the project has been made since its adoption, the plan being continuous, new obstructions being brought down by each flood in the river, and so much of the continuous appropriation as may be required each year will be applied to their removal.

The amount expended upon this work prior to June 30, 1872, can not now be ascertained, for the reason that during that time and to March 3, 1879, appropriations were made in lump sums, principally under the titles of "Improvement of Mississippi, Missouri, and Arkansas rivers," to be applied to several streams as their needs or the terms of the laws required, and the available records do not show the amount applied to each stream.

The approximate amount expended from July 1, 1872, to June 30, 1880, was $493,437.23, and the definitely known amount expended from July 1, 1880, to June 30, 1908, was $2,103,956.82, making the total of approximate and known expenditures to date $2,597,394.05.

From March 28, 1868, the earliest date of available record of work done, to June 30, 1908, 91,838 snags were pulled, 58 wrecks and 609 drift piles were removed, and 441,664 trees were cut, greatly improving the river and lessening the dangers of navigation.

Two steel-hull snag boats were engaged in removing the obstructions to navigation between the mouth of the Missouri River and New Orleans, La., a distance of about 1,270 miles. During the year 3,744 snags were destroyed, 19 drift piles and 6 wrecks were removed, 5,175 trees were cut, and 20,811 miles patrolled.

A part of the funds appropriated for the removal of obstructions was expended in the partial removal of Beaver Dam rock, an obstructive and dangerous rock lying in mid-channel about 1 mile below Commerce, Mo. A beginning was made upon this work, which can only be done economically at low and favorable river stages, and it will be continued until completed as opportunity offers and funds are available.

For information as to the commerce benefited by this work, reference should be made to the commercial statistics in the report upon improving the Mississippi River between the Ohio and Missouri rivers and in the reports of the Mississippi River Commission and the district officers thereunder. The amount expended during the year was $97,889.35.

(See Appendix Y 1.)

2. Mississippi River between Ohio and Missouri rivers.—In its original condition the navigable channel of this section of the Mississippi River had a natural depth in many places of only 3½ to 4

feet at low water. The main channels were divided by islands and bars, which formed chutes and sloughs and secondary channels, through which a considerable part of the volume of the flow was diverted, to the detriment of navigation.

The first effort to improve this condition was begun in 1872 and was continued for a number of years as appropriations were made, the works of improvement consisting of dikes and dams of brush and stone to confine the low-water volume in the vicinity to a single channel and of revetments to hold and preserve the banks where it was deemed necessary or advisable to do so.

The project followed in latter years and up to the present time has been that adopted in 1881, approved by letter of the Chief of Engineers dated March 31, 1881, contemplating the confinement of the flow of the river to a single channel having an approximate width below St. Louis of 2,500 feet at bank-full stage, the natural width in many cases being a mile or more at mean high water; this result to be secured by closing sloughs and secondary channels and by building out new banks where the natural width is excessive, using for the purpose permeable dikes or hurdles of piling to collect and hold the solid matter carried in suspension or rolled on the bottom by the river; the banks, both new and old, to be revetted or otherwise protected where necessary to secure permanency. Modifications of the project in the river and harbor acts of 1896 and 1902 provided that, pending the completion of the permanent improvement, the low-water channel be improved each season by the use of dredges and other temporary expedients. By report of a Board of Engineers in 1903 the cost of the work remaining to be done was estimated at $20,000,000, with annual expenses of $400,000 for maintenance, but it was hoped that the cost might be materially reduced by a more extensive use of dredging, which was made one of the recommendations. (See Annual Report of the Chief of Engineers for 1904, p. 2144 et seq.)

The river and harbor act of March 3, 1905, made a radical departure from the project of 1881, above outlined, confining the work of improvement to dredging and authorizing the construction of two additional hydraulic dredges of the most approved type, which will be available during the coming low-water season.

This change of plan threatened to put an end to the work of permanent improvement, but by joint resolution of Congress approved June 29, 1906, the Secretary of War was authorized, in his discretion, to expend any portion of the balance then remaining to the credit of this improvement for the repair or completion of improvements already under way or for the construction of other works in accordance with general plans already made or approved, provided that such expenditures should be made only for improvements useful for purposes of navigation.

The river and harbor act of March 2, 1907, reaffirmed dependence upon dredging as the principal means of improvement, and, as subsidiary thereto, provided also for the maintenance and repair of existing works of permanent improvement, and finally for the construction of similar works with any portion of the appropriation not necessary for the accomplishment of the purposes first named. The allotment, however, was reduced to about 40 per cent of that hitherto usual. Continuing contracts to the amount of $750,000, of which

$500,000, is yet to be appropriated, were authorized and the expenditure in each year limited to $250,000 approximately.

Increase is not now recommended, as the amount fixed upon practically indicates the will of Congress until after report of the special survey, for which separate provision was made, having in view an examination and discussion of a plan to be recommended for the future improvement of a part of the river, including this section.

The object of the previous and present plans of improvement is to obtain and maintain a minimum depth at standard low water of 6 feet from the mouth of the Missouri to St. Louis and of 8 feet from St. Louis to the mouth of the Ohio.

The amount expended to June 30, 1908, was $12,376,301.59, exclusive of $180,000 allotted by acts to projects for improvement between the Illinois and Missouri rivers, including Alton Harbor.

The result of the expenditure of this amount has been the partial improvement of the entire extent of the river from St. Louis to Cairo.

The new appropriation asked for is the estimated expenditure for one year only, and should be increased by authorization under continuing contracts for other years by at least the same sum annually until the new plan is authorized by Congress.

It is proposed to expend the new appropriation asked for in dredging and in such temporary and permanent channel improvements as may be necessary and authorized by law.

The amount expended during the fiscal year ending June 30, 1908, was $464,470.78, and includes $102,710.89 expended for dredging. The total amount thus far expended for temporary channel improvements is $1,032,778.47, much of which has been for plant that is now on hand and available for future work. The approximate value of this plant is $414,031.99.

This improvement has probably had a beneficial influence on freight rates, as the rates to localities reached by water are well known to be lower than those remote from this advantage, but an accurate estimation of such effect is impracticable.

During the past year there was maintained a channel depth of 8 feet during the entire season when unobstructed by ice, except in November when, for short periods at several places, the depths were 7 feet until dredges could be brought into action upon these shoals, when the required depth was quickly obtained.

The river at St. Louis reached a high-water stage of 30.9 feet above standard low water (4 feet St. Louis gauge) on June 20, 1908, and a low-water stage of 2.3 feet below standard low water on February 4, 1908.

With the present appliances and such others as are authorized for the temporary improvement of low-water channels it is expected that a navigable depth of about 8 feet can be maintained between St. Louis and Cairo during all stages of river open to navigation.

Recapitulation of commercial statistics.

	1904.	1905.	1906.	1907.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Receipts and shipments at St. Louis	377,935	370,425	416,855	368,075
Transferred by ferries at St. Louis	6,080,109	6,684,949	7,374,978	8,905,542
Shipped from landings between St. Louis and Cairo	43,672	69,729	62,238	65,467
Total	6,501,716	7,125,103	7,854,071	9,339,084

July 1, 1907, balance unexpended		$577,581.60
Amount appropriated by sundry civil act approved May 27, 1908		250,000.00
June 30, 1908, miscellaneous receipts		13,593.04
		841,174.64
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$68,061.21	
For maintenance of improvement	396,409.57	
		[a] 464,470.78
July 1, 1908, balance unexpended		376,703.86
July 1, 1908, outstanding liabilities		21,709.98
July 1, 1908, balance available		354,993.88
July 1, 1908, amount covered by uncompleted contracts		68,738.17
Amount (estimated) required for completion of existing project		17,751,654.55
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		250,000.00

(See Appendix Y 2.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE ROCK ISLAND, ILLINOIS, DISTRICT.

This district was in the charge of Maj. C. S. Riché, Corps of Engineers. Division engineer, Col. W. H. Bixby, Corps of Engineers.

1. Operating snag boats and dredge boats on Illinois and upper Mississippi rivers.—By the river and harbor act of August 11, 1888, provision was made for securing the uninterrupted work of snag boats and dredge boats on the upper Mississippi River under a permanent appropriation, the sum so expended not to exceed $25,000 annually.

By river and harbor act of March 2, 1907, the annual appropriation for operating snag boats on the upper Mississippi River was made available for similar purposes on the Illinois River from its mouth to Copperas Creek.

During the past fiscal year the snag boat *David Tipton* (formerly *Colonel A. Mackenzie*) was employed from July 1 to November 2, 1907, and from May 7 to June 30, 1908, in removing snags and other obstructions, and otherwise assisting the interests of navigation in the upper Mississippi River between Minneapolis and the mouth of Missouri River. The Illinois River was not visited by the snag boat during the fiscal year on account of continuous high water in that stream.

The U. S. hydraulic dredge *Hecla* was employed September 25 to October 31, 1907, in removing obstructions at the steamboat landing at Keokuk, and from May 1 to 8, 1908, in similar work at Fort Madison.

The *Davis*, hydraulic dredge, hired by the Government, was engaged during a portion of June, 1908, in removing deposits above Moline Lock.

[a] Deduct $13.25 expended during the year on account of inspections for the Isthmian Canal Commission, leaving net amount of $464,457.53 expended upon the improvement.

The total amount expended for snag-boat service to June 30, 1908, was $1,024,584.

The total quantity of freight transported on the upper Mississippi River during the calendar year 1907 was about 3,919,440 tons, and the ton-miles 532,899,223; in 1906, 3,847,319 tons, and 698,031,841 ton-miles.

The amount expended during the fiscal year ending June 30, 1908, was $25,000.

(See Appendix Z 1.)

2. Mississippi River between Missouri River and Minneapolis, Minn.—Between Missouri River and St. Paul, Minn.—Under this head is carried on the improvement of through navigation and also such special harbor or levee work as is provided for by Congress. Systematic work was begun in 1878, and such good results have been secured as to demonstrate that with a continuance of operations under liberal appropriations the low-water channel of the Mississippi River between St. Paul and the Missouri River can be made sufficiently deep, available, and permanent to satisfy the demands of commerce.

The original condition of the channel between the Missouri River and St. Paul was such that in low stages the larger boats were unable to proceed farther upstream than La Crosse or Winona, and in many seasons at points much lower down their progress was checked or seriously hindered.

The original project for the improvement, adopted in 1879, proposed the contraction of the channel or waterway by means of wing and closing dams, to such an extent as, by means of the scour caused, to afford a channel of sufficient width and of a depth of 4½ feet at low water. For this project no estimate was ever made. There was expended under the original project and the provisional modified project of 1897 to June 30, 1908, $12,099,152.38, of which about $725,000 was applied to maintenance. At that date and for many years previous the condition of the channel was such as to permit the passage of the largest river boats at very low stages to St. Paul. It should be noted that of the amount above stated, $1,058,000, has been expended for harbors and levees not connected with through-channel improvement, and that there is still available for these purposes $10,050.35.

The existing project, for the purpose of ultimately securing and maintaining a depth of 6 feet, was adopted by Congress March 2, 1907, and is given in full with detailed estimate in House Document No. 341, Fifty-ninth Congress, second session. It provides for further contraction of the channel, for auxiliary dredging, for a lateral canal at Rock Island Rapids and deepening Des Moines Rapids Canal, for repairs to existing work and for maintenance during construction. The estimate of cost, which does not include work between St. Paul and Minneapolis, is $20,000,000, provided it be completed within twenty years, and for care and maintenance after completion, $300,000 per annum. The said act appropriated $500,000, and authorized contracts for prosecuting this work to the amount of $1,500,000 additional, of which $1,000,000 is yet to be appropriated, and limited the cost of work for each year to $500,000 for three years. To June 30, 1908, the amount expended on this project was $369,483.69.

During the past year work has been carried on by hired labor and use of Government plant at Beef Slough bar, at Pine Island Bend, in vicinity of mouth of Zumbro River, in vicinity of Winona, at Dresbach Island, at River Junction, in Guttenberg channel, at Rock Island Rapids, at Clarksville and Elsah, and under formal contract at Horse Island, at Buffalo, at Andalusia, above New Boston, at Tully Island, at Curtis Point, and Fabius Island. At all localities where work was performed good results were obtained.

With the expenditure during the past year an increased depth was obtained at several localities. Needed repairs were made to dams and shore protections that were broken, settled, or otherwise damaged.

The maximum draft that could be carried June 30, 1908, from the Missouri River to St. Paul, 658 miles, at mean low water (stage 1.5 above extreme low water), was, as nearly as could be ascertained, 4.5 feet. During the past year, on account of prevailing high stages of the river, there has at no point been less than 7 feet in the channel, except at the Des Moines Rapids Canal.

The navigation interests are important, especially those pertaining to logs and lumber. The amount of freight carried during the season of 1907, was about 3,919,440 tons, having an approximate valuation of $39,563,669, the tonnage being about 3 per cent, and the valuation 15 per cent more than in 1906. The number of ton-miles was 532,899,222.

The amount estimated as a profitable expenditure is to be used in the continuation of improvement work in accordance with the 6-foot project adopted by Congress, March 2, 1907, for the purpose of extension of benefits of navigation. It is the estimated expenditure for one year only.

An instance of the effect of river improvement and water competition on freight rates applying to that portion of the Mississippi River in question, taken from report of Upper Mississippi River Improvement Association of 1905, is here given:

A comparison of freight rates between points having water competition and an inland point.

From—	To—	Miles.	Route.	Classes.				
				1.	2.	3.	4.	5.
St. Louis	St. Paul	578	Rail	$0.63	$0.52½	$0.42	$0.26	$0.21
Do	do	729	Boat	.40	.34	.27	.17	.14
Do	Oklahoma	543	Rail	1.30	1.09	.97	.84	.67

Other instances collected by the office in 1908 regarding canned goods in boxes, a medium class of freight, are:

From—	To—	Miles.	Route.	Rate per hundredweight.
				Cents.
Rock Island	La Crosse	213	Rail	23.0
		219	Boat	15.0
Do	Burlington	83	Rail	11.6
		81	Boat	8.0

While it is not claimed that river improvements are solely responsible for the great differences in freight rates above shown, it is well

known that wherever water competition exists, whether by river, canal, or lake, its effect on freight rates is always beneficial to the public, and that so long as the navigation of the Mississippi River is practicable and somewhat in proportion to the feasibility of that navigation, such benefits will accrue, even if but little river commerce is actually carried on.

It is noted that the rate charged by the railroads on both banks of the river on freight from St. Louis to St. Paul is about 50 per cent greater than that charged by steamboats, and that the railroad rate to an inland point having no water competition, but at about the same distance, is more than 200 per cent greater.

The same ratio prevails for lesser distances.

A classification of the freight carried by steamboats in 1905 was found impracticable, but on the least favorable showing above given (fifth class) the saving was $0.07 per 100 pounds for 600 miles, or $0.00233 per ton-mile, which amounts in round numbers to $1,600,000 for that year. It is to be remembered that benefit also accrues to the public in the reduction of rates on freight carried by rail, the amount of which freight, although not definitely known, is thought to be much greater than that carried by boats. Were the improvement of the river to be abandoned and no further navigation practicable, the loss to the public during each year, on the basis of the rates to inland points, would be several millions.

The continued prosecution of the improvement to a greater extent than in recent years seems advisable, in order that the condition of the river for through navigation be maintained and gradually improved. It is not anticipated that any further material reduction in freight rates on the adjacent railways will thus be had, but there would be danger that any lessened efficiency of the river for navigation would soon result in an increase in freight rates on adjacent railways, and the volume of freight that might thus be affected is so great that a very small increase on these rail rates would annually exceed in total amount the recent annual appropriations for the improvement of the portion of river in question.

For repairing, enlarging, and strengthening the Warsaw to Quincy levee, and for protecting the bank of the river adjacent, there has been expended to June 30, 1908, $105,500. This levee is 39 miles in length, running along the east bank of the Mississippi River, and was built by property owners. In May, 1908, a dam was constructed and 1,450 linear feet of shore protection raised to top of bank, and the balance of the appropriation was expended.

For constructing, repairing, and revetting the Flint Creek to Iowa River levee and for protecting adjacent river bank there has been expended to June 30, 1908, $299,556.48. This levee runs from a point about 7 miles up the Iowa River down the west bank of that river and of the Mississippi River to Flint Creek, near Burlington, Iowa. No work was done during the year.

For dredging Quincy Bay there has been expended to June 30, 1908, $129,481.36, and for Quincy Bay and bar at Quincy, $26,178.21 additional. No work was done during the year.

For the construction of a harbor of refuge below Davenport, Iowa, there has been expended to June 30, 1908, $13,068.05, for raising and repairing the dam at the head of Rockingham Slough, dredg-

ing, sinking cribs, and driving piles. No work was done during the year.

For channel at Clinton, Iowa, there has been expended to June 30, 1908, $25,000, the entire amount of appropriation. No work was performed during the past year, but that done in the previous year and previously reported was paid for in July, 1907.

For the channel and harbor at Hannibal, Mo., there has been expended to June 30, 1908, $14,762.67. No work was done during the past year.

For the harbor at Muscatine, Iowa, there has been expended to June 30, 1908, $43,148.60. Considerable dredging was done during the year both above and below the high bridge.

For the harbor of refuge at Pepin, Wis., on Lake Pepin, there has been expended to June 30, 1908, $20,554.66. No work was done during the past year on account of high water.

For dredging at harbors and landing places there has been expended to June 30, 1908, $37,842.51. Satisfactory work was done during the past year at La Crosse, Dubuque, Fulton, Moline, Andalusia, and Hamburg.

July 1, 1907, balance unexpended	$713,430.18
Amount appropriated by sundry civil act of May 27, 1908	500,000.00
Receipts from sales	126.71
	1,213,556.89
June 30, 1908, amount expended during fiscal year for works of improvement	572,863.52
July 1, 1908, balance unexpended	640,693.37
July 1, 1908, outstanding liabilities	53,974.23
July 1, 1908, balance available	586,719.14
July 1, 1908, amount covered by uncompleted contracts	102,669.20
Amount (estimated) required for completion of existing project	19,000,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	500,000.00

(See Appendix Z 2.)

3. Operating and care of Des Moines Rapids Canal and dry dock.—During the past fiscal year the Des Moines Rapids Canal was open for navigation two hundred and forty-three days, during which time there passed through it 1,290 steamboats and 223 barges, carrying 28,247 passengers, 11,448 tons of merchandise, and 200 bushels of grain. There also passed through the canal 3,640,640 feet B. M. of lumber, 3,200,000 feet of logs, 1,000,000 shingles, and 1,000,000 laths. This statement is much less than that of the previous year, but is of little value, as on account of prevailing high stages of water during this and the four previous years most of the rafts and many boats have passed over the rapids instead of through the canal.

The draft afforded by the canal is 5 feet at extreme low water, which may be increased to 6 at high stages. There are three locks, having an available length of 325 feet and width of 78.5 feet.

The dry dock was in constant use during the entire year.

The cost of operating and care of the canal is provided for by an indefinite appropriation made by act of July 5, 1884.

The total expenditures to June 30, 1908, amounted to $1,304,018.18, of which $42,007.60 was expended during the past year.

(See Appendix Z 3.)

4. Mississippi River at Moline, Ill.—The river and harbor act of March 3, 1905, adopted a definite project for improving Mississippi River at Moline, Ill., by excavating a channel 250 feet wide and 4 feet deep at low water from the city of Moline, Ill., to the head of the so-called arsenal dike above the city, and a similar channel connecting with the main river by means of a lock and dam at the foot of Benhams Island opposite the city, at an estimated cost of $386,000, and $10,000 annually for operation, care, and maintenance.

The entire amount of the estimate has been appropriated.

The amount expended to June 30, 1908, is $369,969.70.

The lock was practically completed and opened to navigation December 23, 1907.

The completion of rock excavation in upper approach remains to be done. It is thought that no further appropriations will be necessary.

For reference to the approved project, see annual report of the Chief of Engineers for 1905, page 429.

July 1, 1907, balance unexpended	$150,647.71
For refundment of overpayment	1.25
	150,648.96
June 30, 1908, amount expended during fiscal year for works of improvement	134,618.66
July 1, 1908, balance unexpended	16,030.30
July 1, 1908, outstanding liabilities	471.41
July 1, 1908, balance available	15,558.89

(See Appendix Z 4.)

5. Operating and care of lock at Moline, Ill.—This lock, which admits boats to Moline and also forms a link in the 6-foot channel improvement of Rock Island Rapids, was formally opened to navigation December 23, 1907. It was immediately closed for the winter and reopened March 18, 1908. During the past fiscal year the lock was in use one hundred and five days, during which time there passed through it 1,534 boats and barges, carrying 19,247 tons of freight and 4,054 passengers.

The draft afforded by the lock is 6 feet at extreme low water. It has an available length of 325 feet and width of 80 feet.

The cost of operating and care of Moline Lock is provided for by an indefinite appropriation made by act of July 5, 1884.

The expenditures to June 30, 1908, amounted to $4,799.03, and were incurred during the past year.

(See Appendix Z 5.)

6. Operating and care of Illinois and Mississippi Canal around the lower rapids of Rock River at Milan, Ill.—This portion of the canal is 4½ miles in length, surmounting a fall of 18 feet, and was formally opened to navigation April 17, 1895. During the past fiscal year the canal was in use two hundred and fifty-eight days, during which time there passed through it 2,165 boats and barges, carrying 794 tons of freight and 6,661 passengers.

The commercial traffic was about one-fifth of that of the previous year.

The draft afforded by the canal is 7 feet.

The locks, 3 in number, have a length of 170 feet between miter sills and a width of 35 feet.

The cost of operating and care of the canal is provided for by an indefinite appropriation made by act of July 5, 1884.

The expenditures to June 30, 1908, amounted to $109,070.38, of which $13,428.19 was expended during the past year.

(See Appendix Z 6.)

7. Illinois and Mississippi Canal: Improvement of Rock River pool.—Work commenced in the early part of 1907 was completed later in the year under a project and an allotment from the appropriation for construction of the canal for improving the reach of Rock River, extending from Lock 29 to Lock 35. This project provides for a channel 80 feet wide and 5 feet deep at low water by means of rock excavation and ordinary dredging of sand and gravel. Dipper dredges *Apache* and *Ajax* were employed, the former three months, the latter one month, in removing broken rock, blue clay, and bowlders, and about 25,000 cubic yards of material was taken out. About 900 linear feet of the channel has a width of only 65 feet. The amount expended during the year is $10,113.27; the total expended to June 30, 1908, being $20,000.

(See Appendix Z 7.)

8. Operating and care of Galena River improvement, Illinois.—This improvement, consisting of a lock and dam in the Galena River, was purchased by the United States in March, 1894, under provisions of the act of September 19, 1890, at a cost of $100,000.

During the past fiscal year the lock was open for navigation two hundred and thirty days, in which time there passed through it 2,891 boats and barges, carrying 11,408 passengers and 3,874 tons of merchandise, which traffic was about equal to that of the previous year.

The draft that can be carried at extreme low water is 2 feet, as limited by the depth on the lower miter sill of the lock, which has an available length of 280 feet and width of 52 feet.

The cost of operating and care of the improvement is provided for under an indefinite appropriation made by act of July 5, 1884, and the amount expended to June 30, 1908, is $76,907.44.

The amount expended during the year is $4,000.

(See Appendix Z 8.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE ST. PAUL, MINNESOTA, DISTRICT.

This district was in the temporary charge of Capt. E. H. Schulz, Corps of Engineers, to September 4, 1907, and in the charge of Maj. Francis R. Shunk, Corps of Engineers, since that date. Division engineer, Col. W. H. Bixby, Corps of Engineers.

1. Mississippi River between St. Paul and Minneapolis, Minn.—This section of the Mississippi River, from the Chicago, St. Paul, Minneapolis and Omaha Railway bridge in St. Paul to Washington Avenue Bridge in Minneapolis, is 11.4 miles long. Before improve-

ment, boats drawing 3 feet could go up at ordinary low water as far as the mouth of the Minnesota River, 2.66 miles above the Chicago, St. Paul, Minneapolis and Omaha Railway bridge. From the Minnesota River to the present site of Dam No. 2, a distance of 6.56 miles, there was a channel about 2½ feet deep, but on account of the velocity of the current upstream freighting was difficult and unprofitable. From this point to the Washington Avenue Bridge, a distance of 2.18 miles, the depth was not more than 2 feet at ordinary low stage, and the velocity such as effectually to prevent navigation. Before 1894 work was done in this part of the river under allotments from the appropriations for "Improving the Mississippi River from the landing on the west bank below the Washington Avenue Bridge, Minneapolis, to the Des Moines Rapids." A total amount of $59,098.70 was thus expended in dredging, bank protection, and construction of wing dams. As a result considerable improvement was made in the navigable reaches, but the limits of navigation were not extended.

In 1894 a separate project was adopted for the Mississippi River between St. Paul and Minneapolis. It provided for two locks and dams: One (No. 1) just above the mouth of Minnehaha Creek, and 3.68 miles above the Minnesota River, to have a lift of 13.3 feet; another (No. 2) 2.88 miles above No. 1 and 2.18 miles below Washington Avenue Bridge, Minneapolis, to have a lift of 13.8 feet. The lock chambers were to be 80 feet by 334 feet, and the depth on the lower miter sills 5 feet at low water.

This project was modified by the act of March 2, 1907, which requires a channel depth of 6 feet instead of 5 feet. This will make it necessary to increase the lifts of the two dams, and to take measures for increasing the depth on the lower miter sill of Lock No. 1 to 6 feet at low water; but funds for this work have not as yet been provided by Congress.

The river and harbor act approved March 3, 1899, authorized the completion of Lock and Dam No. 2, together with Lock and Dam No. 1, under continuing contracts or otherwise, at a total cost, for both locks and dams, of $1,166,457. An increase in the limit of cost to $1,466,000 was authorized by the river and harbor act approved March 3, 1905. This act authorized continuing contracts for the completion of the work in the sum of $299,543, of which $239,543 still remains to be appropriated.

The amount expended under this project to June 30, 1908, was $1,061,396.78, of which $2,792.43 was for maintenance.

Lock and Dam No. 2 is now completed and has been in operation since May, 1907. Lock No. 1 is about 20 per cent completed, but no work has yet been done on Dam No. 1. The whole project is about 70 per cent completed.

Until the completion of Lock and Dam No. 1, the work can not have much beneficial effect on the navigability of the river.

The usual variation of level of water surface is about 8 feet, with a maximum variation of about 16 feet.

The head of navigation for large boats now is the mouth of the Minnesota River, 2.7 miles above the Chicago, St. Paul, Minneapolis and Omaha Railway bridge in St. Paul. The reach from the mouth of the Minnesota River to Minnehaha Creek, a distance of 3.3 miles, is regularly used by light-draft excursion boats.

At the present time the principal commerce is the passage of logs, loose and rafted. During the calendar year 1907, 72,000,000 feet B. M. of logs, approximately 300,000 tons, with an estimated value of $900,000, was floated down the river. The excursion business amounts to about $15,000 per annum.

The construction of the two locks and dams will develop a passenger traffic between St. Paul and Minneapolis, and is expected to reduce the freight rate on flour and grain shipped from Minneapolis.

It is proposed to expend the amount estimated as a profitable expenditure during the fiscal year 1910 in completing Lock and Dam No. 1.

July 1, 1907, balance unexpended	$293,897.38
Amount derived from sales	2,349.59
	296,246.97
June 30, 1908, amount expended during fiscal year for works of improvement	128,823.97
July 1, 1908, balance unexpended	167,423.00
July 1, 1908, outstanding liabilities	14,845.50
July 1, 1908, balance available	152,577.50
Amount (estimated) required for completion of existing project	239,543.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	239,543.00

(See Appendix A A 1.)

2. Operating and care of Lock No. 2, Mississippi River between St. Paul and Minneapolis, Minn.—This lock and dam were completed in 1906, and their maintenance and operation have been provided for since July 1, 1907, by an allotment from the appropriation for "Operating and care of canals and other works of navigation."

The amount expended to June 30, 1908, is $5,578.45, incurred during the past year.

Lock and Dam No. 2 is the first of a series of two between St. Paul and Minneapolis, Minn., the object of which was to provide slackwater navigation over the stretch of river between Minnehaha Creek and the Washington Avenue Bridge, Minneapolis, Minn. No. 2 is the upper one of the series and was constructed first because navigation on the section above was extremely difficult and hazardous under the most favorable conditions, and virtually impossible at low stages of the river.

Since the completion of this lock and dam the river above is navigable up to Washington Avenue Bridge, Minneapolis, for boats drawing 5 feet. Until Lock and Dam No. 1 are completed, however, the full benefit of Lock and Dam No. 2 can not be felt, since the river between the two locks is very difficult of navigation in its present condition.

During the year 72,000,000 feet B. M. of logs passed the dam. The weight of these logs was about 300,000 tons and their value about $900,000. There were eleven lockages of rafting and excursion boats.

(See Appendix A A 2.)

3. Reservoirs at headwaters of Mississippi River and Mississippi River between Brainerd and Grand Rapids, Minn.—Under this title are included two entirely separate improvements, which are separately considered:

(*a*) *Reservoirs at headwaters of Mississippi River.*—These works are intended to improve navigable depths on the Mississippi River above Lake Pepin. Before improvement the river was subject to fluctuations of level between wide limits and was often unnavigable at low stages.

The project adopted in 1880 called for the construction of forty-one reservoirs in Minnesota and Wisconsin to collect surplus water from the precipitation of winter, spring, and early summer, and release it systematically during low water so as to benefit navigation on the Mississippi River. The estimated cost, exclusive of land and flowage easements, was $1,809,083.

In compliance with act of Congress of August 5, 1886, the Chief of Engineers, in 1887, recommended that the reservoirs originally contemplated on the St. Croix, Chippewa, and Wisconsin rivers be not constructed. Subsequent acts of Congress have been in accord with this recommendation, and the project is considered as modified to the extent recommended. (See Annual Report of the Chief of Engineers for 1887, pp. 1681 et seq.)

The act of March 2, 1907, authorized the construction of a reservoir at Gull Lake, Minnesota, at an estimated cost of $70,000, provided that the necessary land and flowage easements be acquired without cost to the United States. This condition has not been fulfilled. The same act authorized the reconstruction of Sandy Lake dam, without a lock for steamboats, at an estimated cost of $75,000. This provision was amended by section 5 of an act (Public, No. 153) approved May 28, 1908, by striking out the words "without a lock for steamboats."

The total expenditure up to June 30, 1908, was $1,429,762.95, of which $638,732.56 was for original construction, $428,903.69 for renewal and maintenance, $125,390.89 for acquisition of land and flowage rights, including surveys, and the remainder for operating expenses, damages, and contingencies.

The sum of $233.65 has been received on account of refundments and the sale of material.

Five timber dams were built, at Lake Winnibigoshish, Leech Lake, Pokegama Falls, Pine River, and Sandy Lake. The first four have been rebuilt in concrete, and the building of a new concrete dam at Sandy Lake is now in progress.

Title to 6,040 acres of land has been acquired, and flowage rights on 4,328 acres.

Since 1898 operations have been confined to the completion, renewal, and repair of existing works, surveys, and acquisition of necessary land and flowage easements.

The expenditure as a whole has resulted in benefit during the low-water season to the navigable portions of the Mississippi River from Cass Lake, Minn., to Lake Pepin, and incidentally in the mitigation of the floods in the river above St. Paul. The chief benefit has probably been to commerce on the Mississippi River, from St. Paul down.

The effect on freight rates has been considerable, both on the upper river and below St. Paul. Without the reservoirs steamboat trans-

portation would scarcely be possible during low water between Brainerd and Grand Rapids, and freight would have to be carried by wagons at great expense. It is a fact that railroad freight from St. Paul to St. Louis, a distance of 600 miles, is only 5 per cent higher than the rate from St. Paul to Chicago, 400 miles; and that steamboat freight rates to river points below St. Paul are in general about one-third lower than those of the railroads. Some portion of this reduction is doubtless due to the reservoirs.

(*b*) *Mississippi River between Brainerd and Grand Rapids, Minn.*—By act of June 13, 1902, this improvement was added to the project for reservoirs. Work of snagging, bowlder removal, etc., had been done on this part of the river under a project (now expired) for "Improving Mississippi River above the Falls of St. Anthony." The present project contemplates continuation of such work. No estimate of cost has been adopted.

Up to June 30, 1908, $19,000.96 had been expended. As a result the channel between Brainerd and Grand Rapids was greatly improved by removal of snags, overhanging trees, bowlders, etc. The maximum draft that can be carried at low water on the Mississippi River above Brainerd depends upon the manipulation of the reservoirs. The amount of water discharged varies with the requirements of navigation, but a depth of 4 feet could probably be maintained throughout the low-water season if necessary. The usual variation in level is about 10 feet. Cass Lake, 283 miles above Brainerd, is the head of navigation.

There are two steamboats and several launches operating on the Mississippi River between Brainerd and Grand Rapids. During the season of 1907 these boats carried about 6,000 tons of miscellaneous freight, of an estimated value of $450,000, and about 4,000 passengers. In addition to the above about 26,000,000 feet B. M. of railway ties, cedar poles, and pulp wood, in rafts, and about 275,000,000 feet B. M. of loose logs were floated over this section of the river. The combined weight of the last two items was about 1,055,000 tons and the value about $3,600,000.

There are no railroads paralleling the portion of the river under improvement, and inhabitants of the adjacent country are dependent upon the river as a means of transportation. The work of improving the channel has given a safer and more commodious channel, and has doubtless kept down freight rates.

Under the whole project no additional appropriations are needed for expenditure during the fiscal year ending June 30, 1910. It is proposed to expend the available funds for building a lock at Sandy Lake, building dikes, acquisition of land, etc.

July 1, 1907, balance unexpended	$283,097.65
Amount derived from sales and refundment	195.00
	283,292.65
June 30, 1908, amount expended during fiscal year for works of improvement	61,322.91
July 1, 1908, balance unexpended	221,969.74
July 1, 1908, outstanding liabilities	8,630.34
July 1, 1908, balance available	213,339.40

(See Appendix A A 3.)

4. Operating and care of reservoirs at headwaters of Mississippi River.—Before 1894 the expenses of operation were paid from the appropriations for construction. By act of August 18, 1894, the "care, preservation, and maintenance" of the reservoirs were included under the appropriation for "Operating and care of canals and other works of navigation." Annual allotments have since been made from that appropriation.

The care, preservation, and maintenance of the reservoirs include repairs to dams, dikes, buildings, roads, telephone lines, etc., and the payment of salaries to dam tenders and gauge readers.

The reservoirs are operated mainly with a view to the improvement of navigation on the Mississippi River, but with due regard to other legitimate interests. Incidentally they are of great benefit in mitigating floods and in regulating the flow of water for power purposes. No definite schedule can be determined beforehand, but the following are the general rules observed in operation:

(*a*) The discharge must not, by operation of the reservoirs, be reduced below the normal low-water flow of the streams affected. This rule is necessary in the interests of manufacturers.

(*b*) When logs arrive in the reservoirs they must be sluiced through. Transportation of logs by floating is a form of commerce and the main form of commerce on the streams affected by the reservoir. It is dangerous to the dams to allow accumulations of logs so that they must be sluiced through even in times of flood.

(*c*) The winter flow is so regulated as to make room for 39,000,000,000 cubic feet of water at the end of winter. This is the amount ordinarily to be expected in the spring floods.

(*d*) From the spring thaw until the dry season of summer (ordinarily until about July 10) as much water is retained in the reservoirs as possible, subject to rules (*a*) and (*b*).

(*e*) When the gauge at St. Paul has fallen nearly to 3 feet (which reading indicates a channel depth at St. Paul of 5 feet) water is released so as to keep the gauge at this reading. If there is not enough water for this purpose, then the greatest constant depth possible is maintained.

(*f*) When, during the low-water stage, there is not sufficient depth for the steamer plying between Aitkin and Grand Rapids and the quantity of water in the reservoirs is sufficient, enough water is released, on request, to make a trip possible. This use of the reservoirs is occasional.

The total amount expended up to June 30, 1908, was $251,205.38, of which $16,448.92 was expended during the past year. As a result the river has been maintained during the summers of most years at a navigable stage in its upper portion and from St. Paul to Lake Pepin. Flood heights in the Mississippi have been reduced, often by several feet, and the benefit to manufacturing interests, due to the more uniform flow, has been very great.

For capacities of reservoirs, maps of region, and comparison of rainfall and run-off, see Annual Reports of the Chief of Engineers for 1896, page 1841, and 1905, page 1678. For break in Pine River reservoir, see Annual Reports of the Chief of Engineers for 1896, page 1844, and for 1897, page 2144. For diagrams showing how much water had been stored each year in each reservoir, see Annual Report of the Chief of Engineers for 1900, Part 4, page 2798. For

distribution of liabilities incurred during the fiscal years 1898 to 1905, see Annual Report of the Chief of Engineers for 1905, pages 1676–1677. For Report of Board of Engineers upon matters connected with the operation of the reservoirs, see Annual Report of the Chief of Engineers for 1906, Part 2, page 1443.

(See Appendix A A 4.)

5. St. Croix River, Wisconsin and Minnesota.—Before improvement the ruling low-water depth on the bars above Lake St. Croix was 2 feet. In Lake St. Croix the channel was in most places 8 to 10 feet deep, but narrow and tortuous.

The project was adopted in 1875, and amended as to estimates of cost in 1882 and 1889. By act of June 3, 1896, the improvement of the harbor and water front of Stillwater was added to the project.

The end sought was to provide a commodious channel 3 feet deep at low water from Taylors Falls to the Mississippi River, a distance of 52.3 miles, and to give adequate harbor facilities at Stillwater. This was to be done by means of dredging in Lake St. Croix and at Stillwater and by dredging and contraction works above Lake St. Croix. The estimate of cost, as finally modified, was $136,700. The project was completed in 1900.

Since that time work of maintenance has been done. The appropriations have not been sufficient to accomplish all that was desired, and the channel above Lake St. Croix has deteriorated so as to be scarcely navigable at low stages. This deterioration is mainly due to the choking of the river by snags and sunken logs.

The amount expended to June 30, 1908, was $146,967.26, of which the amount spent since 1900, $15,557.76, was for maintenance only.

Regular appropriations of $3,600 per annum are needed for the maintenance of this improvement.

The maximum draft that could be carried June 30, 1908, at low water was 3 feet at and below Stillwater. Above Stillwater it was not more than 2 feet. Taylors Falls, about 52 miles from its mouth, is the head of navigation on this stream. The usual variation of level of water surface is about 6 feet.

The commerce of this river is chiefly in logs which are floated loose to Stillwater, Minn., and rafted below that place. About 78,000,000 feet B. M. of loose logs were floated during the season of 1907, their weight being about 273,000 tons and their value about $936,000. About 60,000,000 feet B. M. of logs and manufactured lumber, 15,000,000 laths, and 6,000,000 shingles were rafted below Stillwater, nine steamboats being engaged in these operations. One steamboat made daily trips during the season between Osceola, Wis., and Taylors Falls, Minn., carrying passengers and a little freight, but no information could be obtained of the amount of business done. A gasoline passenger launch made daily trips, whenever the state of the river would permit, between Stillwater and Taylors Falls. About 1,800 passengers were carried during the season. No freight to speak of has been carried on the river in recent years. The work done has had no effect on freight rates.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year 1910 to dredging and the repair of wing dams, such work being necessary to make previous improvements available.

Reports on examinations of this river have been published as follows: Ordered by act of June 23, 1874, Ex. Doc. No. 75 (part 6) 43d Congress, 2d sess.; report dated January 26, 1880, Report of the Chief of Engineers for 1880, p. 1661; ordered by river and harbor act of September 19, 1890, Annual Report of the Chief of Engineers for 1891, p. 2218; ordered by river and harbor act of March 3, 1899, Annual Report of the Chief of Engineers for 1900, p. 2837; ordered by river and harbor act of March 3, 1905, House Doc. No. 686, 59th Congress, 1st sess.

July 1, 1907, balance unexpended	$3,831.66
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,433.92
July 1, 1908, balance unexpended	397.74
July 1, 1908, outstanding liabilities	46.50
July 1, 1908, balance available	351.24
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	3,600.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix A A 5.)

6. *Minnesota River, Minnesota.*—Before improvement the ruling low-water depth at the entrance to Minnesota River was not more than 2 feet. From the mouth to Shakopee, a distance of 23.7 miles, there was a least low-water depth of 7 feet, and from Shakopee to Little Rapids, 11.8 miles, a least depth of 3 feet. From Little Rapids to Mankato, a distance of 78.2 miles, the river was navigable only at the higher stages. Above Mankato navigation was possible only at very high water. Along the entire course the channel was obstructed by bowlders, snags, and overhanging trees.

The project, adopted in 1867, provided for the removal of snags, bowlders, etc., from Yellow Medicine River to the mouth, a distance of 237 miles. The estimate of cost was $117,000. In 1893 the project was modified to include the construction of a low-water dam across the mouth of the river at Pike Island, and the excavation of a new channel through Fort Snelling Chute at the head of Pike Island. When the Minnesota River is low, the Mississippi River, at the head of Pike Island, is ordinarily higher than the Minnesota, and the object of the dam and new channel was to raise the level of the Minnesota at and near Little Rapids during low stages as well as to provide a better entrance. The estimated cost of the new work was $10,000. The project was completed in 1895. Work done since that time has been in maintenance of the channel at the mouth.

By act of June 13, 1902, $2,500 was appropriated for the removal of the dam at Pike Island, should the Secretary of War in his discretion so determine. The dam has not yet been removed. Recent investigation having shown that the dam was in very bad condition, and that such navigation as there now is would be benefited by its removal, the Secretary of War on May 26, 1908, authorized its removal.

Amount expended to June 30, 1908, was $135,605.07, of which $4,105.82 was for maintenance of existing improvements.

Appropriations since 1896 have been very small and irregular and have all been applied to the maintenance of the improvement at the mouth of the river, for which purpose they have not been sufficient.

Regular appropriations of $2,000 per annum are needed for the maintenance of this improvement.

The maximum draft that could be carried June 30, 1908, at low water is limited to about 2 feet by the undredged portion of the bar at the outlet. Little Rapids, 36 miles from the mouth, may be considered the head of navigation at present, although at high stages navigation is possible to Le Sueur, 88 miles from the mouth.

No commerce now exists on this stream, which is used only by pleasure launches and occasional excursion steamers.

The Minnesota River has no effect on commerce or freight rates, as vessels of commercial size can not enter it.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year 1910 to dredging the river from its mouth to about 2 miles above.

For historical sketches see Annual Report of the Chief of Engineers for 1879 and 1894, pages 1182 and 1725, respectively.

For description and physical characteristics see Report of the Chief of Engineers for 1875, page 381. Reports of examinations have been published as follows: Ex. Doc. No. 76, 43d Cong., 2d sess.; Ex. Doc. Nos. 249 and 1335, 53d Cong., 2d sess.; Report of the Chief of Engineers for 1895, pages 2206 and 2208; Report of the Chief of Engineers for 1897, page 1834; Report of the Chief of Engineers for 1900, page 2834; Report of the Chief of Engineers for 1904, page 2260; House Doc. No. 493, 60th Cong., 1st sess.

July 1, 1907, balance unexpended	$2,145.77
June 13, 1902, appropriation for "Removing dam near mouth"	2,500.00
	4,645.77
June 30, 1908, amount expended during fiscal year, for maintenance of improvement	250.84
July 1, 1908, balance unexpended	4,394.93
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix A A 6.)

7. *Red River of the North, Minnesota and North Dakota.*—Under this project are included the improvement of the Red River of the North, Minnesota and North Dakota, and of Red Lake River, Minnesota.

Before improvements the ruling depth at low water in the Red River of the North from the Canadian frontier to Grand Forks, a distance of 143.5 miles, was 2 feet, and from Grand Forks to Moorhead, 155 miles, 1.5 feet. From Moorhead to Breckenridge, 97 miles, navigation was possible only at the higher stages. The river was obstructed by snags, overhanging trees, etc.

Red Lake River from the head of Red Lake to Thief River Falls, a distance of 135 miles, had a low-water depth of at least 3 feet in most places, but was obstructed by a bar at the mouth of the lake and

by bowlders between Thief River Falls and High Landing, a distance of 35 miles, so that the ruling depth was 1.5 feet.

The project for the Red River, adopted in 1878, provided for dredging and removal of obstructions from Breckenridge to the international boundary and the construction of a lock and dam to overcome the fall at Goose Rapids, the whole being with a view to obtain channels as follows:

Breckenridge to Moorhead, 97 miles, a channel capable of being navigated during high and medium stages of water.

Moorhead to Grand Forks, 155 miles, a channel 50 feet wide and 3 feet deep at low water.

Grand Forks to the northern boundary line, 143.5 miles, a channel 60 feet wide and 4 feet deep at low water.

The estimated cost was $364,598.17. This project was modified as follows: In 1883 the estimated cost was increased to $398,598.17. In 1887 the proposed lock and dam at Goose Rapids was dropped from the project and the estimate reduced to $252,598.37. In 1893 the estimate was increased to $310,320.

The improvement of Red Lake River was added to the project in 1896. It was proposed to provide a depth of 3 feet by dredging and removal of bowlders from Thief River Falls to the head of Red Lake. The amount authorized by Congress to be spent on this work was $9,000. The total estimate for both rivers is therefore at present $319,320.

The total amount expended to June 30, 1908, was $333,757.70, of which $31,344.10 was for maintenance. The sum of $159.50 has been returned to the appropriation by the sale of condemned material.

As a result of these expenditures some improvement was made in the few years subsequent to 1878 in the upper section of the river. No work has been done in this section in recent years because there has been no navigation. In the middle section the project was completed, except for 13 miles, in 1894. Since that time the river above Bellmont, N. Dak., has been obstructed by unauthorized bridges which do not permit navigation. In the lower section the project was completed in 1902.

Since the shoals in this river constantly recur, annual work of maintenance is necessary. The funds supplied not having been sufficient to maintain depths contemplated by the project, the navigable depth of the middle section is now 2 feet and of the lower section 3.5 feet. Nothing beyond work of maintenance has been done in recent years; this has been confined to dredging the worst bars in the vicinity of Grand Forks, N. Dak. The expenditure of at least $7,500 annually would be required to keep the navigated portions of the river in condition.

On Red Lake River work has been confined to the removal of snags, bowlders, and similar obstructions from the channel. No work has been done since 1900, and in 1905 the floating plant used for this work was sold by authority of the Secretary of War.

The actual head of navigation on the Red River of the North is Bellmont, N. Dak., about 180 miles by river from the international boundary. The usual variation of water surface is 25 feet; the maximum variation 49 feet.

Red Lake River is navigable from Thief River Falls to the head of Red Lake, a distance of 135 miles. Below Thief River Falls the

river is not navigable. The usual variation of level is about 3.5 feet; the maximum variation about 6 feet.

Red River is regularly used during the summer season by 2 steamboats and 12 barges. During 1907, 8,158 tons of wheat was carried from river points to Grand Forks for transfer to railroads.

Four steamers and 1 launch make use of the Red Lake River, carrying passengers and small amounts of freight. About 62,000,000 feet B. M. of logs were floated down Red Lake River during the season of 1907, their weight being 217,000 tons and their value $700,000.

Rates on the Red River steamers are from 70 to 50 per cent less than the railroad rates between common points.

This project has no apparent effect on railroad freight rates.

It is proposed to apply the amount estimated as a profitable expenditure for the fiscal year 1910 in dredging near Grand Forks, N. Dak.

For physical characteristics see Annual Reports of the Chief of Engineers for 1874, page 295; 1875, page 370; 1878, page 730; 1879, page 1192. For plans of improvements see Annual Reports of the Chief of Engineers for 1874, page 297; 1879, page 1191; 1881, page 1757. For revisions of projects see Annual Reports of the Chief of Engineers for 1883, page 1450; 1887, page 1712. For description of large landslide caused by Northern Pacific Railroad embankment, see Annual Report of the Chief of Engineers for 1898, page 1831. References to reports on examinations ordered by the river and harbor acts of March 3, 1905, and March 2, 1907, will be found in the Annual Report of the Chief of Engineers for 1906, Part 1, page 483, and on page 542 of this report.

July 1, 1907, balance unexpended	$13,580.56
Amount derived from sales	10.00
	13,590.56
June 30, 1908, amount expended during fiscal year for maintenance of improvement	8,565.76
July 1, 1908, balance unexpended	5,024.80
July 1, 1908, outstanding liabilities	912.17
July 1, 1908, balance available	4,112.63
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	7,500.00

(See Appendix A A 7.)

8. Warroad Harbor and Warroad River, Minnesota.—Before improvement there was a good natural harbor of moderate depth at the mouth of Warroad River. Between the harbor and the river there was a bar having a least depth of 3.5 feet at ordinary lake stage (7.2 feet on the gauge) and between the harbor and the lake a bar having a least depth of 5 feet at ordinary lake stage. The channel of the Warroad River from the harbor to the steamboat landing (about 1 mile) was deep but tortuous.

The river and harbor act of 1899, as amended by the act approved June 6, 1900, appropriated $3,000, or so much thereof as might be necessary, for improving the mouth of Warroad River, Minnesota.

Nothing was done under this appropriation beyond making an examination and survey.

The present project was adopted in 1902, and provided for building a dredge and dredging in the harbor a channel sufficient for boats drawing 7 feet of water. The estimated cost was $45,000. This project was modified in 1905 so as to provide for a channel 100 feet wide and 7 feet deep from the inner end of the harbor channel to the boat landing at Warroad, with a turning basin for boats at the inner end, at an estimated cost of $35,000. The total estimate is therefore $80,000.

The total amount expended to June 30, 1908, was $81,750.93, of which $14,628.97 was for work of maintenance. As a result the turning basin was completed, the inner channel dredged for a distance of 4,000 feet to a width of 100 feet and a depth of 9 feet at ordinary stage, and for a distance of 1,800 feet to a width of 200 feet and a depth of 9 feet. The outer channel had been dredged from the harbor to the lake, a distance of 5,400 feet, to a width of 200 feet and a depth of 12 feet, except for a length of 500 feet, where the full width was not attained, but it is expected to complete the project with available funds in the next fiscal year. The maximum draft that can be carried is 8 feet at a stage of 7.2 feet on the lake gauge. This is sufficient for any boat now using the Lake of the Woods.

The head of navigation on Warroad River is at the steamboat landing, about a mile above the mouth.

The bars in this harbor are formed by wave action, and constantly recur. Annual dredging is therefore necessary for maintenance. It is estimated that $4,000 should be expended each year in work of maintenance.

During the season of 1907 the imports and exports amounted to 2,000 tons of miscellaneous freight. Boats using the harbor carried about 2,000 passengers. The value of the business done could not be obtained.

This improvement has no effect on railroad freight rates. There are no railroads in competition with steamers on the lake.

July 1, 1907, balance unexpended		$12,282.41
Amount derived from refundments		590.57
		12,872.98
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$7,355.56	
For maintenance of improvement	3,677.78	
		11,033.34
July 1, 1908, balance unexpended		1,839.64
July 1, 1908, outstanding liabilities		847.81
July 1, 1908, balance available		991.83

(See Appendix A A 8.)

9. Survey of Otter Tail Lake and Otter Tail River and Red Lake and Red Lake River, Minnesota, and of Big Stone Lake and Lake Traverse, Minnesota and South Dakota.—The river and harbor act approved June 13, 1902, provided for the continuation of these surveys, which were ordered by Congress with a view to the construction of reservoirs for the improvement of the navigation of Red River of the North and Minnesota River.

Preliminary reports were submitted in April, 1900, and are printed in the Annual Report of the Chief of Engineers for 1900, pages 2828–2836. A final report was submitted August 11, 1903, and printed in the Annual Report of the Chief of Engineers for 1904, page 2260 et seq.

Amount expended on all projects to June 30, 1908, $17,293.28.

It is proposed to reserve the available funds for the purpose of making hydrological observations during the next flood affecting these localities.

July 1, 1907, balance unexpended	$8,210.90
June 30, 1908, amount expended during fiscal year	4.18
July 1, 1908, balance unexpended	8,206.72

(See Appendix A A 9.)

10. Gauging Mississippi River at or near St. Paul, Minn.—This work is provided for by allotment from the permanent annual appropriation of $9,600 made by the river and harbor act of August 11, 1888, as amended by section 9 of the river and harbor act of June 13, 1902, for the purpose of securing the uninterrupted gauging of the waters of the Mississippi River and its tributaries. No gaugings were made until the fall of 1899. Since then gaugings have been made as frequently as the funds available would permit and the conditions justified the expenditure. For location of gauges see map facing page 1832, Report of the Chief of Engineers for 1898.

Tables showing relation of rainfall to run-off in the Mississippi Valley above St. Paul are printed on page 2169, Report of the Chief of Engineers for 1897. The slope of the Mississippi River between Minneapolis and St. Paul is shown in the Report of the Chief of Engineers for 1900, page 2823.

The amount expended to June 30, 1908, is $7,152.72.

July 1, 1907, balance unexpended	$500.00
Amount returned to Treasury	249.08
	250.92
Allotment for fiscal year 1908	500.00
	750.92
June 30, 1908, amount expended during fiscal year	641.84
July 1, 1908, balance unexpended	109.08
July 1, 1908, outstanding liabilities	109.08

(See Appendix A A 10.)

11. Survey of Lake Minnetonka, Minnesota.—The river and harbor act approved March 3, 1905, provided for the survey of Lake Minnetonka for the purpose of charting only. An allotment of $7,000 was made for the purpose.

Amount expended to June 30, 1908, $5,722.91.

The survey has been completed, the map has been made, and an edition of 2,000 charts printed by photolithography.

The charts are sold at 50 cents each, or $1.50 for 10 copies. At the end of the year 619 copies had been sold and 42 copies distributed to institutions and individuals for educational purposes. The proceeds of sales amounted to $303.05 at the end of the fiscal year, of which the sum of $28 was deposited to the credit of "Miscellaneous receipts."

The balance remaining to the credit of the allotment, $1,467.70, was placed to the credit of the appropriation for "Examinations, Surveys, and Contingencies of Rivers and Harbors," May 2, 1908.

July 1, 1907, balance unexpended	[a]$1,413.38
Received from sale of charts	58.50
	1,471.88
June 30, 1908, amount expended during fiscal year	4.18
May 2, 1908, amount returned to Treasury	1,467.70

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. *Preliminary examination of the Red River of the North, Minnesota and North Dakota.*—Report dated November 13, 1907, is printed in House Document No. 400, Sixtieth Congress, first session. The locality is not considered worthy of improvement further than contemplated by the existing project.

2. *Preliminary examination of Bois de Sioux River, Lake Traverse, and Big Stone Lake, and the portages between the said lakes and said river, with a view to diverting the flood waters of the Red River of the North into the Minnesota River, Minnesota.*—Report dated December 4, 1907, is printed in House Document No. 493, Sixtieth Congress, first session. The proposed improvement is not considered one that should be undertaken.

REPORT ON USE OF SURPLUS WATER FLOWING OVER GOVERNMENT DAMS IN MISSISSIPPI RIVER BETWEEN ST. PAUL AND MINNEAPOLIS, MINN., MADE IN COMPLIANCE WITH ACT OF CONGRESS APPROVED JUNE 25, 1906.

Report dated September 26, 1907, by a commission composed of Maj. W. V. Judson, Corps of Engineers, Mr. J. E. Woodwell, inspector electric lighting plants, Treasury Department, and Maj. Amos W. Kimball, Quartermaster, United States Army, concerning the *use by the United States of waters of the Mississippi River flowing over the dams between St. Paul and Minneapolis, Minn.*, was duly submitted and was transmitted to Congress. It is printed in House Document No. 218, Sixtieth Congress, first session.

IMPROVEMENT OF RIVERS AND HARBORS IN THE KANSAS CITY, MISSOURI, DISTRICT.

This district was in the charge of Capt. E. H. Schulz, Corps of Engineers. Division engineer, Col. W. H. Bixby, Corps of Engineers.

[a] The balance on hand July 1, 1907, was given as $1,497.82 in the report for 1907. The difference of $84.44 is the amount which was returned to the Treasury October 2, 1906, and credited on the books of the St. Paul, Minn., office to the credit of the allotment. It was discovered later that it had been credited to the appropriation for "Examinations, surveys, and contingencies of *rivers and harbors*" without regard to the allotment.

1. Missouri River.—General improvement.—The Missouri River has been navigated by steamboats since 1819; first boat to Council Bluffs, 1819; first to mouth of the Yellowstone, 1832; first to head of navigation, Fort Benton, Mont., 1859. The length of navigable river from Fort Benton to mouth is 2,284.8 miles. Some portions of the river above the Great Falls are also navigable.

The original condition of the river was, and to a great extent the present condition is, one of alternate pools and bars. The low-water depth over bars is about 3 feet and the width of the river at such places is from one-third to 1 mile. In the deep reaches the width is 800 to 1,500 feet and the low-water depth in such places is often over 12 feet. Generally speaking, the navigable low-water depth of unimproved river is 3 feet and of high water only 9 feet. The navigable depth does not increase as rapidly as the water height, since the bars rise with the stage of river. The river is also encumbered with snags, which, however, are getting fewer, due to constant snagging operations.

No project for the improvement of the river as a whole has been adopted.

Government work on the river in the matter of removal of snags began as early as 1838 and continued thereafter, under annual appropriations (for the most part made jointly for the Ohio, Mississippi, Missouri, and sometimes the Arkansas rivers), with occasional intermissions, for the next forty years. Prior to 1878 one or two small appropriations had been made for general improvement, but it was with the act of June 18 of the latter year that appropriations began on a large scale.

The work prior to 1884 was carried on under separate districts.

A project for the river from Sioux City to the mouth was adopted in 1884, the improvement to consist of rectification, revetment, and snagging. In 1890 the project was modified by systematic improvement of the first reach, from Jefferson City to the mouth.

From 1884 to 1890 the work on the entire river was under the Missouri River Commission. After 1890 that portion above and including Sioux City, Iowa, was under a separate district until 1902. Since the discontinuance of the Missouri River Commission the works on the entire river have been consolidated under one district.

The greater part of the work on the portion of the river below Sioux City has been done by the Missouri River Commission, reporting to the Chief of Engineers. The Commission was constituted by act of Congress of July 5, 1884, and was abolished by the river and harbor act of June 13, 1902.

On the portion of the river above Sioux City the work has been done under the immediate charge of officers of the Corps of Engineers, except during the period from 1884 to 1890, when it was in the charge of the Missouri River Commission. The effort of the Commission in its work below Sioux City was to accomplish a continuous, progressive control of the river, contracting it where necessary, giving the channel proper direction, and securely holding it in place. Work in this direction was done in the vicinity of Kansas City and on the first reach of the river, which extends from near Jefferson City to the mouth. On 45 miles of this reach a continuous channel of not less than 6 feet in depth at low water was obtained on what was originally one of the worst parts of the river, in the vicinity of the

mouth of the Osage. In addition to forming a channel, much new land was formed and much land protected from destruction by the river. The greater part of the funds appropriated for expenditure under the direction of the Commission was not applicable to the comprehensive plan of improvement adopted, and about one-third of it was diverted to work at separate localities.

On the upper portion of the river the work originally consisted mainly in improving the shoals and rapids on the so-called "Rocky River" from Fort Benton downstream for 150 miles. In recent years it has largely been limited to channel regulation and bank protection at the following points: Bismarck, N. Dak.; Pierre, Yankton, and Elk Point, S. Dak., and Sioux City, Iowa. Two ice harbors have been established, one at Rockhaven, N. Dak., the other in the mouth of the Big Sioux River, just above Sioux City.

Works of channel regulation have also been built in the Long Pool, or the reach of the river from the crest of the Great Falls to Cascade, and a small amount of open-river work in the steeper stretch from Cascade to Stubbs Ferry.

In addition to the foregoing work a fleet of snag boats has been in operation clearing the channel of snags and other obstructions on the portion of the river where boats have been running. This work is considered to be directly beneficial to navigation.

The total of appropriations for the river, and of receipts from other sources, from the mouth to Sioux City, including snagging, beginning with the act of June 18, 1878, is $9,402,313.13.

The total of the appropriations and of receipts from other sources for improvements of the upper river, including snagging, beginning with the act of August 14, 1876, is $2,288,807.32.

The total expenditures for all purposes have been $11,398,881.35. The result of these expenditures has been to demonstrate the possibility of regulating the river in such manner as to make it navigable for a channel of commerce; that the cost of such regulation would be very great, and that no permanent good to navigation can be accomplished by appropriations for specific localities not so connected as to form part of the systematically improved reaches. The result of the expenditures at separated localities has been beneficial locally by protecting the banks and in this manner preserving private property from the ravages of the river, but has given little, if any, encouragement to through navigation.

At the localities under improvement an effort has been made to maintain the existing and prevailing depth of channel. The least depth at mean low water over the shoalest part at the localities under improvement is not less than 6 feet. The usual variation of level of water is about 19 feet at Kansas City, 8 feet at Fort Benton, and 25 feet at St. Charles.

The maximum draft June 30, 1908, at mean low water from Kansas City to mouth is 4 feet, from Kansas City to Sioux City 3½, and from Sioux City to Fort Benton 3 feet. The head of navigation is Fort Benton, 2,285 miles above the mouth. Above this point rapids begin, which at Great Falls are a series of falls, the aggregate fall being 500 feet. Above Great Falls, there is a navigable depth practically to Three Forks.

The river formerly carried an active commerce, which has been entirely diverted to other channels. This commerce now shows healthy signs of reviving.

Commerce has increased greatly on the lower river from Kansas City to the mouth, there now being two boats regularly running from Kansas City to St. Louis, each making a round trip every eight to ten days, and averaging a round trip cargo of 600 tons. There is also a boat running from Jefferson City to St. Louis, and several boats plying between Osage River and St. Louis.

The character of upstream cargoes is merchandise and general supplies; downstream, grain and stock.

Amount of freight carried on the Missouri River from mouth to Sioux City, Iowa.

Calendar year—	Tons.	Calendar year—	Tons.
1897	391,029	1903	750,291
1898	319,793	1904	455,000
1899	263,114	1905	343,435
1900	277,306	1906	573,348
1901	569,666	1907	843,863
1902	410,527		

Amount of freight carried on the Missouri River above Sioux City, Iowa.

Calendar year—	Tons.	Calendar year—	Tons
1887	13,961	1898	26,896
1888	12,895	1899	23,041
1889	16,723	1900	27,179
1890	14,072	1901	37,340
1891	14,211	1902	31,070
1892	17,292	1903	37,994
1893	19,481	1904	28,951
1894	37,936	1905	52,956
1895	21,264	1906	43,987
1896	10,368	1907	45,123
1897	17,105		

The effect of the improvement has been to equalize and keep down freight rates, the actual river rates being about 60 per cent of the railroad rates.

The purpose to which the estimated amount for June 30, 1910, is to be applied, is for snagging and maintaining the improvement, thus benefiting and fostering through navigation.

A condensed description of the works on the river executed under the supervision of the Missouri River Commission is given in the Commission's last annual report (Annual Report of the Chief of Engineers for 1902, Supplement).

A condensed description of the work above the Great Falls will be found in the Annual Report of the Chief of Engineers for 1899, pages 385–386, and in later annual reports; and of the work on the river between Fort Benton and Sioux City in the Annual Report of the Chief of Engineers for 1902, pages 382–385.

A complete survey of the river has also been made, in part by the Commission and in part by officers in charge of the districts on the upper portions of the river.

Previous reports: For reports of examinations and surveys above Sioux City, see page 71, List of Preliminary Examinations and Surveys, Document No. 421, Fifty-seventh Congress, second session. The examinations made above Sioux City were generally for local points. For reports below Sioux City, see page 110, same document. For list of projects see pages 182 and 184, same document.

The only report covering the entire stretch from Sioux City to the mouth is that of February 2, 1881, by Major Suter, found in Annual Report, Chief of Engineers, of 1881, page 1649.

There is no existing project, except the use of such limited funds as have been appropriated since 1902 for purposes of snagging and emergency dike and revetment work. A new project and estimate of cost for improvement for 6-foot and 12-foot channel, from Sioux City to Kansas City and Kansas City to mouth, called for by act of Congress, March 2, 1907, has been prepared and will be submitted for transmission to Congress at its next session.

During the past year work has been in the main confined to repair work and snagging. New work was done as follows:

Extensive dike work was built at Elwood, Kans., to prevent the river from leaving St. Joseph, Mo., and to protect banks and railroad bridge at Elwood. Half the cost of this work ($50,000) was contributed by the railroads concerned.

Extensive revetment work was also done by the Chicago & Alton Railroad at Cambridge Bend, to protect their railroad bridge at Glasgow, Mo.

A survey of the river was made at Omaha, Nebr., and Atchison, Kans.

A survey and report, December 26, 1907, with estimate of cost, was also made of the Missouri River near Lake Contrary, St. Joseph, Mo. (See H. Doc. No. 824, 60th Cong., 1st sess.)

Snagging.—The removal of snags has formed a part of the scheme for improving both the lower and upper river since the work of improvement began. As snags form the most dangerous obstacle to navigation on this stream, their removal has been one of the most efficacious aids to its navigation. At present one snag boat on each division of the river regularly operates over such portions as are used by commercial vessels.

The work of the past fiscal year has consisted mainly in repair work and snagging carried on under the appropriation act of March 2, 1907, which provides that the amounts appropriated shall be applied in the first instance to the purpose of clearing the river of snags with a view to navigation, and that no part of such amount shall be applied for revetment or protection of banks of the stream unless such revetment or protection is directly and necessarily required for purposes of navigation.

Projects have been approved for the expenditure of these sums and work has begun in accordance therewith.

UPPER RIVER (ABOVE SIOUX CITY, IOWA).

July 1, 1907, balance unexpended		$107,399.40
Received from sale of transferred property		5,097.12
Received from overpayments		1.50
		112,498.02
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$25,879.19	
For maintenance of improvement	20,919.33	
		46,798.52
July 1, 1908, balance unexpended		65,699.50
July 1, 1908, outstanding liabilities		4,280.20
July 1, 1908, balance available		61,419.30
Amount (estimated) required for completion of existing project		Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

LOWER RIVER (BELOW SIOUX CITY, IOWA).

July 1, 1907, balance unexpended		$317,227.15
Amount allotted from emergency appropriation, act of March 3, 1905		10,000.00
Amount allotted from emergency appropriation, act of March 2, 1907		10,000.00
Received from sale of property		276.31
Received from sale of maps		32.49
Received from overpayments		41.20
		337,577.15
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$19,615.71	
For maintenance of improvement	104,742.15	
		124,357.86
July 1, 1908, balance unexpended		213,219.29
July 1, 1908, outstanding liabilities		37,317.02
July 1, 1908, balance available		175,902.27
Amount (estimated) required for completion of existing project		Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		(a)

LOWER RIVER, AT ELWOOD, KANS. (CONTRIBUTION).

Total sum contributed	[b] $50,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	36,679.69
July 1, 1908, balance unexpended	13,320.31
July 1, 1908, outstanding liabilities	91.44
July 1, 1908, balance available	13,228.87

[a] See consolidated money statement on page 548.
[b] Amount deposited by railroad companies, September 12 and October 3, 1907.

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July 1, 1907, balance unexpended		$424,626.55
Amount allotted from emergency appropriations of March 3, 1905, and March 2, 1907		20,000.00
Amount contributed by private parties		50,000.00
Amount received from sales, etc		5,448.62
		500,075.17
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$82,174.59	
For maintenance of improvement	125,661.48	
		207,836.07
July 1, 1908, balance unexpended		292,239.10
July 1, 1908, outstanding liabilities		41,688.66
July 1, 1908, balance available		250,550.44
Amount (estimated) required for completion of existing project		Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		350,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix B B 1.)

2. Osage River, Missouri.—A history of the work of improvement on this river, from the adoption of the original project in 1871 to the end of the fiscal year 1900, was published in the Annual Report of the Chief of Engineers for 1900, page 4944.

The original condition was one of alternate pools and shoals.

The work has been carried on under two projects—that of open-channel improvement, by the construction of cross and wing dams, in addition to dredging and removal of obstructions to navigation, such as snags, etc., and the construction of a lock and dam 7 miles above the mouth of the river.

The removal of obstructions under the first project contemplates maintenance. The obstructions will form anew, and while the cross and wing dams have a degree of permanency, they must receive frequent repair and extension to keep up their efficiency.

The amount expended by the General Government upon both projects up to June 30, 1908, is $732,974.33.

By the act of March 2, 1907, the sum of $10,000 was appropriated for general improvement and $68,000 was appropriated for continuing construction of Lock and Dam No. 1, with authority for contracts to the additional amount of $160,000, of which $60,000 is yet to be appropriated for completion of the lock and dam.

During the past year work has consisted in additional protection to the lock and pier No. 1. Additional protection for weirs 6 to 10 is now in progress.

It is proposed to use the amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908, for works of improvement, in completion of Lock and Dam No. 1 ($60,000) and for maintenance of general improvement, including snagging, dredging, and repairs to dikes ($20,000).

Previous reports: Preliminary examinations August 22, 1884, and December 10, 1886. Reports of surveys December 28, 1870, February 11, 1875, February 13, 1879, April 21, 1881, January 9, 1890, November 9, 1900. Project adopted in 1871; snagging, dredging, and wing dams, modified in 1890 by one lock and dam near mouth.

Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 551 of this report.

Amount of freight carried on the Osage River.

Calendar year—	Tons.	Calendar year—	Tons.
1895	76,706	1902	95,194
1896	72,393	1903	38,501
1897	71,247	1904	35,746
1898	84,286	1905	8,678
1899	76,702	1906	20,506
1900	96,144	1907	31,601
1901	72,339		

July 1, 1907, balance unexpended		$107,779.10
Amount appropriated by sundry civil act approved May 27, 1908		100,000.00
		207,779.10
June 30, 1908, amount expended during fiscal year for maintenance of improvement		55,421.60
July 1, 1908, balance unexpended		152,357.50
July 1, 1908, outstanding liabilities		8,745.85
July 1, 1908, balance available		143,611.65
Amount (estimated) required for completion of existing project		[a] 60,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908:		
For works of improvement	[a] $60,000.00	
For maintenance of improvement	20,000.00	
		80,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix B B 2.)

3. Gasconade River, Missouri.—This river is similar to the Osage, consisting of alternate shoals and pools. The project for the improvement of this stream, adopted in 1880, consisted in the removal of snags and logs from the channel and of leaning timber from the banks of the river, where necessary, and the construction of wing dams and training walls to concentrate the flow of water upon the shoals to increase the depth over them.

From the nature of the project, which contemplates maintenance and relief from year to year and the removal of obstructions which are constantly forming anew, no definite time can be fixed for its completion. The improvement must therefore be continuous.

During the past season the boating channel was cleared of snags and wreck heaps and all overhanging trees were trimmed or felled.

The total of the appropriations and of receipts from other sources for the improvement of Gasconade River, beginning with the act of June 14, 1880, is $111,624.31.

The amount expended under the project to June 30, 1908, is $109,466.15.

[a] For lock and dam.

It is proposed to use the amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908, for works of improvement in continuing present project, which is indefinite, including plant to carry on work, and for maintenance of existing works.

The head of navigation is Arlington, Mo., and the number of navigable miles is 107.

Amount of freight carried on the Gasconade River.

Calendar year—	Tons.	Calendar year—	Tons.
1895	47,544	1902	44,380
1896	46,294	1903	10,788
1897	30,515	1904	14,791
1898	30,981	1905	29,837
1899	24,259	1906	27,604
1900	51,580	1907	50,083
1901	19,460		

Previous reports: Reports of previous surveys, February 14, 1873, Annual Report Chief of Engineers, page 479, 1873; February 11, 1880, Annual Report Chief of Engineers, page 1462, 1880; June 30, 1896, Annual Report Chief of Engineers, page 3800, 1896. Notes on river also found on page 3539, Annual Report Chief of Engineers, 1898.

Reference to report on examination made in compliance with act of March 2, 1907, will be found at the bottom of this page.

July 1, 1907, balance unexpended	$9,918.70
June 30, 1908, amount expended during fiscal year for maintenance of improvement	7,760.54
July 1, 1908, balance unexpended	2,158.16
Amount (estimated) required for completion of existing project	Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	27,500.00

(See Appendix B B 3.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Survey of Missouri River at St. Joseph, Mo., with a view to preventing a cut-off into Lake Contrary and other lakes.—Report dated December 26, 1907, is printed in House Document No. 824, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $150,000 is presented.

2. Preliminary examination with plan and estimate of cost of improvement of Gasconade River, Missouri, from its mouth to Gascondy.—Reports dated June 4, 1907, and February 24, 1908, are

printed in House Document No. 829, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $110,000, or for a progressive improvement with an annual appropriation is presented.

3. Preliminary examination with plan and estimate of cost of improvement of Osage River, Missouri, from its mouth to the mouth of Niangua River.—Reports dated June 4, 1907, and January 21, 1908, are printed in House Document No. 960, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $305,000 is presented.

The local officer was also charged with the duty of making a preliminary examination and survey of *Missouri River, from the mouth to Sioux City*, provided for in the river and harbor act of March 2, 1907, and reports thereon will be duly submitted.

IMPROVEMENT OF RIVERS AND HARBORS IN THE NASHVILLE, TENNESSEE, DISTRICT.

This district was in the charge of Maj. Wm. W. Harts, Corps of Engineers, having under his immediate orders First Lieut. W. G. Caples, Corps of Engineers, to October 20, 1907, and Capt. Alfred B. Putnam, Corps of Engineers, since October 18, 1907. Division engineer, Col. E. H. Ruffner, Corps of Engineers, to February 28, 1908, and Col. W. T. Rossell, Corps of Engineers, since that date.

1. Obion and Forked Deer rivers, Tennessee.—The river and harbor act of June 13, 1902, authorized the joint improvement of the Obion and Forked Deer rivers.

(*a*) *Obion River.*—This stream is situated in northwestern Tennessee. It is formed by the junction of its North and South forks about 6 miles northeast of Obion, which is considered the head of navigation, and it flows in a general southwesterly direction about 75 miles, entering the Mississippi River some 5 miles below the Missouri and Arkansas State line.

In its original condition the obstructions on this river were almost wholly drift, snags, and overhanging trees, which made navigation difficult and uncertain.

The original project was based on a survey made in 1891, and was adopted by the river and harbor act of July 13, 1892. The scope of the work was to obtain 3-foot navigation at low water by means of open-channel work, at an estimated cost of $50,000. After an expenditure of $15,795.01 this project was modified in June, 1897, to one for maintenance, so as to keep the river free from such obstructions as would prevent navigation at medium and high stages, at an estimated annual cost of $2,500.

In 1903 the annual expenditure recommended for maintenance of the Obion and Forked Deer rivers was reduced from $4,500 to $2,250. (See Annual Report for 1904, p. 2351.)

Appropriations and allotments aggregating $29,400 have been made for the Obion River, of which $12,391.78 has been expended under the present project to June 30, 1908.

The expenditures have resulted in temporary improvements to the channel, lessening the dangers to navigation at medium and higher stages from Obion, Tenn., to mouth of river. The navigability of the Obion River depends largely on the stage of water in the Mississippi. Navigation is not practicable at low stages.

For the calendar year ending December 31, 1907, the reported commerce on this stream amounted to 26,247 tons, having an estimated value of about $115,109, consisting almost wholly of timber products.

For additional details of the Obion River, see the account of its survey in the Annual Report of 1891, page 2992. The effect of the improvement on freight rates is not believed to be important and can not readily be ascertained.

The district officer expresses the opinion, for reasons stated in his report, that further appropriations under this project are not warranted.

July 1, 1907, balance unexpended	$2,247.50
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,034.29
July 1, 1908, balance unexpended	1,213.21
July 1, 1908, outstanding liabilities	13.00
July 1, 1908, balance available	1,200.21

(*b*) *Forked Deer River.*—This stream is formed by the junction of its North and South forks about 8 miles southwest of Dyersburg, and flows thence in a general southwesterly direction about 21 miles, entering the Obion River about 3½ miles from the Mississippi. Dyersburg is considered the head of navigation on the North Fork. Jackson, Tenn., was formerly considered the head of navigation on the South Fork, but in recent years navigation appears to have been limited to the lower portion of this stream.

In their original condition the main stream and its branches, the North Fork and South Fork, were greatly obstructed by snags and drift. The original project may be said to have been adopted by the river and harbor act of August 2, 1882, and was based on a report of an examination of South Fork, dated December 16, 1880. This project was subsequently modified by extension to include the North Fork and main stream until appropriations aggregating $25,000 were made and expended. The operations proposed were open-channel work, by which it was sought to maintain a satisfactory channel all the year round. This project was set aside in view of the fact that the result aimed at could not be accomplished by this method.

The present project for maintenance, based on the provisions of the act of March 3, 1899, provided for the removal of surface obstructions from the Forked Deer River and its navigable branches (North and South forks), at an estimated annual cost of $2,000. In 1903 the annual expenditure recommended for maintenance of both the Obion and Forked Deer rivers was reduced from $4,500 to $2,250. (See Annual Report for 1904, p. 2351.) Under this project appropriations and allotments aggregating $12,600 have been made, of which $11,614.83 has been expended to June 30, 1908. The expenditures have resulted in temporary improvements to the channel, lessening the dangers to navigation at medium and higher stages. The navigability of the Forked Deer River depends largely upon the stage of water in the Mississippi. Navigation is not practicable at low stages.

For the calendar year ending December 31, 1907, the reported commerce on this stream amounted to 13,058 tons, having an estimated value of about $53,891, and consisting almost wholly of timber products; passengers carried, 400.

For list of sundry examinations and surveys of Forked Deer River and its navigable branches, see Report of Chief of Engineers for 1899, page 396. For report of latest examination of Obion and Forked Deer rivers, see Report of Chief of Engineers for 1904, page 2351 et seq.

The effect of the improvement on freight rates it not believed to be important and can not readily be ascertained.

This river has been combined with the Obion in the work of improvement, and they have ordinarily been considered together in making appropriations of funds.

The district officer expresses the opinion, for reasons stated in his report on Obion River, that further appropriations under this project are not warranted.

July 1, 1907, balance unexpended	$1,716.21
June 30, 1908, amount expended during fiscal year for maintenance of improvement	731.04
July 1, 1908, balance unexpended	985.17
July 1, 1908, outstanding liabilities	11.50
July 1, 1908, balance available	973.67

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July 1, 1907, balance unexpended	$3,963.71
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,765.33
July 1, 1908, balance unexpended	2,198.38
July 1, 1908, outstanding liabilities	24.50
July 1, 1908, balance available	2,173.88

(See Appendix C C 1.)

2. Cumberland River, Tennessee and Kentucky.—The Cumberland River rises in eastern Kentucky, on the western slope of the Cumberland Mountains, flows in a tortuous course of about 688 miles through eastern Kentucky, middle Tennessee, and western Kentucky, and discharges into the Ohio River near Smithland, Ky. From Burnside, Ky., the head of steamboat navigation, to Smithland, Ky., the distance is 518 miles by the river, 203 miles being in the State of Kentucky and 315 miles in the State of Tennessee.

(*a*) *Below Nashville (193 miles)*.—From 1830 to 1840 the legislatures of Tennessee and Kentucky made several appropriations for the improvement of the navigation of the Cumberland River, but little benefit to the general condition of the river seems to have been accomplished. The Cumberland Navigation Company was incorporated by the State of Tennessee in 1846 for improving the "navigation of the Cumberland River below the town of Nashville by means of a system of locks and dams," but nothing effective was done to carry out the proposed improvement.

In its original condition this section of the river was considerably obstructed by rocky ledges, conglomerate, gravel and sand bars, snags, and other surface obstructions, on account of which navigation was rendered very uncertain.

From July 17, 1832, to July 7, 1838, Congress made five appropriations for improving the Cumberland River, Tennessee and Kentucky, aggregating $155,000, $20,000 of which was to be expended below Nashville and $135,000 on the river generally, but all the appropriations for the above period were expended below Nashville, to improve the worst localities.

Between 1838 and 1871 no appropriations for this river were made. The original project (open-channel work), which provided specifically for operations on this section, was adopted by the river and harbor act of March 3, 1871, based on project submitted January 20, 1871. The work proposed was as follows: To excavate the bars and rock ledges in order to get an additional depth of water, to contract the waterways in places in order to get the requisite depth, to remove snags and bowlders from the main channel, and to restrain tributary streams in well-determined channels at their junction with the river.

To increase the depth of water at the shoals in Kentucky Chute at the junction of the Cumberland with the Ohio River, a Board of Engineer officers in 1888 recommended the construction of a dike near Smithland, Ky., at an estimated cost of $129,600. The river and harbor act of September 19, 1890, allotted $30,000 from the appropriation for improving Cumberland River below Nashville, to be expended in improving the mouth of the river, as recommended.

Appropriations aggregating $305,000 were made and expended, thus completing the above project. The expenditures under the old project have resulted in lengthening the season of navigation by giving an increased depth at low water combined with greater security in the passage of obstructions.

The present project for improving the Cumberland River below Nashville was adopted July 13, 1892, by river and harbor act of that date. It contemplates the extension of the lock and dam system of the upper river over a considerable portion of the river below Nashville by the construction of 7 locks and dams, commencing at or near Harpeth shoal (Lock A) and ending at Big Eddy shoal (Lock G); the locks to be 52 feet wide and 280 feet long, with lifts varying from 8½ to 11½ feet and aggregating some 70 feet. The project also includes the improvement of the Kentucky Chute, at the mouth of the river, as recommended by the Board of Engineer officers in 1888, the necessary channel work below Lock G, and the removal of surface obstructions, snags, logs, etc., below Nashville. The total estimated cost of the entire improvement is $1,964,500. (Annual Report of the Chief of Engineers for 1894, page 1806.)

Under this project appropriations aggregate $440,000, which, with receipts from sales and repayments, $974.05, makes a total of $440,974.05.

The total expenditures under this project to June 30, 1908, amount to $432,242.61, of which sum about $20,897.60 has been applied to maintenance.

These expenditures have resulted in the periodical removal of snags and other surface obstructions from the navigable channel, the protection of the bank of a part of Cumberland Island in Kentucky Chute at the mouth of the river, and the completion and placing in operation of Lock A, whereby 6-foot navigation has been afforded all year round for a distance of 38.8 miles above the lock. The season of profitable navigation from the Ohio River to Nashville has been prolonged by forty-five to ninety days, depending on the stage of water, making it now average eight months annually.

The Cumberland River below Nashville is usually navigable for all steamboats plying on it for six months in each year; for boats not drawing over 3 feet, from six to eight months, and for boats drawing 16 inches or less, the whole year. General navigation, however, is practically closed for several months each year during low water.

As a general rule, when the stage is below 2½ feet, navigation is closed; between 2½ feet and 5 feet, it is uncertain, and above 5 feet, good. A table is given on page 390 of the Annual Report of the Chief of Engineers for 1902 showing the stages at Burnside, Carthage, Nashville, and Clarksville for the years 1898–1902.

The reported commerce for the calendar year 1907 was 300,810 tons, having an estimated value of about $5,877,957; passengers carried, 14,000. The tonnage consisted principally of timber products, grain, and general merchandise.

It is reported that the Tennessee Central Railroad, which parallels the Cumberland River from Nashville to Clarksville, had rates in force before the completion of Lock and Dam A of from 18 to 26 cents per 100 pounds, and since this lock was put in operation these rates have been reduced above the lock to from 6 cents to 12 cents per 100 pounds.

The quantity of grain handled by the local steamboats has increased considerably since the completion of Lock A.

The balance available will be applied to expenses of making complete location survey for locks and dams in Cumberland River below Nashville, authorized by the act of March 2, 1907, and to the necessary maintenance.

A preliminary report of this survey is printed in House Document No. 758, Sixtieth Congress, first session.

The amount estimated as a profitable expenditure in the fiscal year ending June 30, 1910, will be applied to necessary maintenance. The funds are needed for an extension of benefits and for maintaining the river in a navigable condition.

Additional details and maps relating to this section are given in the report of survey, Annual Report of 1890, page 2152, and the report of the Board of Engineer officers, Annual Report of 1888, page 1626.

For report of the Board of Engineers for Rivers and Harbors under date of February 26, 1906, concerning the further improvement of Cumberland River, see House Document No. 699, Fifty-ninth Congress, first session.

It is deemed advisable that provision should be made for the necessary surveys to locate sites and for acquisition of land required for the additional locks and dams to be constructed under the adopted project in order to avoid delays incident to such work after appropriations for actual construction have been made.

July 1, 1907, balance unexpended		$21,400.78
June 30, 1908, amount expended during fiscal year:		
For survey	$9,781.88	
For maintenance of improvement	2,887.46	
		12,669.34
July 1, 1908, balance unexpended		8,731.44
July 1, 1908, outstanding liabilities		897.92
July 1, 1908, balance available		7,833.52
Amount (estimated) required for completion of existing project		1,549,818.81
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*b*) *Above Nashville* (*357 miles*).—This section extends from Nashville to the mouth of Rockcastle River. In its original condition it was considerably obstructed by rock reefs, ledges, snags, etc., which greatly impeded navigation between Nashville and Burnside (about 325 miles), while above Burnside the Smith shoals formed a serious obstruction to navigation at practically all stages.

The original scheme of improvement above Nashville, as modified and extended, contemplated open-channel work from Nashville, Tenn., to Cumberland Ford (Pineville, Ky.), 497 miles, at an estimated cost of $374,764, and was based on projects submitted January 20, 1871, and February 8, 1872.

The first appropriation, specifically applicable to the Cumberland River above Nashville, was made by the act of August 14, 1876.

This open-channel scheme of improvement, or old project, resulted in giving increased depths at several of the principal obstructions, thus securing a longer and safer period of navigation. Under this project and its modifications appropriations aggregating $346,000 were made and expended.

The project for the canalization of the Cumberland River above Nashville, based on reports of an examination and survey in 1882 and 1883, was adopted by the river and harbor act of August 5, 1886.

This scheme of improvement provided for the construction of 22 locks and dams below Burnside, Ky., and 6 locks and dams at Smith shoals, above Burnside, the intention being to provide a complete system of lockage from Nashville, Tenn., to Rockcastle River, so as to afford a channel depth of 6 feet, the locks to be 52 feet wide and 280 feet long, with lifts varying from 10 to 12 feet, at an estimated cost of $8,500,000.

The river and harbor act of March 3, 1905, authorized continuing contract for the completion of Lock and Dam No. 21, to the amount of $200,000, in addition to a direct appropriation of $74,000 and the available funds to the credit of any project above said lock and dam.

The entire amount authorized by this act has been appropriated. Owing to financial difficulties the Continental Engineering and Contracting Company, of Buffalo, N. Y., who had the contract for the construction of Lock and Dam No. 21, gave up their contract, which was duly annulled May 23, 1908, and the unfinished portion of their work is being undertaken by hired labor. The district officer, in the appendix to this report, recommends that an additional sum of $85,000 be appropriated to finish the work at Lock 21, as experience shows that it will be impossible to build the dam and do the necessary work of bank protection and paving within the present estimate of cost. His recommendation is concurred in.

On February 16, 1905, the Board of Engineers for Rivers and Harbors reported on the project of canalization as follows:

> The Board is of the opinion that the regulation of the river and * * * the completion of Locks and Dams 3, 4, 5, 6, and 7 above Nashville, so as to carry the improvement of the river from its mouth to Carthage, Tenn., is worthy of being continued by the United States, but that the construction of the locks and dams proposed between Carthage and Burnside, except No. 21, now under contract, is not at present justified by the commerce involved.

The river and harbor act of March 2, 1907, adopted the modified project for completing the improvement in accordance with this report, by providing for the completion of Locks and Dams Nos.

3, 4, 5, 6, and 7 at an additional expenditure of $550,000, thus reducing the cost of the project as modified to $2,769,000, increased in this report to $2,854,000. The act appropriated $150,000 and authorized continuing contracts in the further sum of $400,000 for completing the project. Of the latter amount $250,000 is still to be appropriated.

Under the project of canalization, appropriations aggregating $2,519,000 have been made; $475.90 has been received from recoveries, sales, etc., making a total of $2,519,475.90. Of this amount about $32,036.95 is chargeable to maintenance, leaving $2,487,438.95 applicable to works of improvement. The total expenditures under this project to June 30, 1908, amount to $2,120,426.31, of which sum about $31,349.87 was applied to maintenance.

These expenditures have resulted in the periodical removal of snags and other obstructions; the completion and operation of Lock and Dam No. 1 (2.5 miles below Nashville); and Lock and Dam No. 2 (9 miles above Nashville); the completion of the masonry required for locks and abutments of Dams Nos. 3, 4, 5, 6, and 7 (26, 44.7, 72, 89, and 106.6 miles, respectively, above Nashville); the purchase of sites for abutment at Lock No. 8 (125.2 miles above Nashville), and for Lock and Abutment No. 22 (320.2 miles above Nashville); the selection of sites for the locks of the Smith shoals system; the letting and partial execution of the contracts for the construction and erection of the gates for Locks 3 to 7, and for Lock 21; the partial construction of Lock 21; the purchase and delivery of the lumber for Dams Nos. 3 and 5; and contingencies pertaining to the entire improvement.

The Cumberland River is navigable usually from Nashville to Burnside, Ky., 325 miles, for steamboats drawing not more than 3 feet from four to six months of each year, and for boats of greater draft from two to three months. The fall is 223 feet, or about 8 inches per mile.

From Nashville to Caney Fork River (Carthage, 116 miles) the river is navigable for steamboats of 2½ feet draft from six to eight months, and for those of greater draft four or five months. Steamboats of light draft can ascend to Burkesville, 236 miles above Nashville, for from five to seven months and larger boats four or five months. The head of navigation is Burnside, Ky.

The completion of Lock and Dam No. 1 gives 6-foot navigation the year round for a distance of 12½ miles above Lock No. 1, or 10 miles above Nashville, and affords a good harbor at Nashville, where a number of new boats and barges were put in commission as a result of the improvement.

Lock No. 2 was put in operation on October 9, 1907. The completion of this lock forms a pool extending to a point 26 miles above Nashville. Under the contract with the Penn Bridge Company for the gates for Locks 3 to 7 those for No. 3 were to have been erected not later than October 31, 1907, but this time limit was waived for proper cause. It is expected to place both Locks 3 and 5 in operation during the coming autumn. The contract with the Penn Bridge Company calls for the erection of the gates as follows: Locks 4 and 5, not later than October 31, 1908; Locks 6 and 7, not later than October 31, 1909.

The early completion of the work at Locks 3, 4, 5, 6, and 7, where the more expensive masonry parts have already been built, is regarded of great importance, as this is necessary to make the improve-

ment available and will provide a permanent channel for navigation from Nashville to Carthage and the Caney Fork River. When these locks are in operation the effect of the project on freight rates will be more fully apparent.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year 1910 as follows: Two hundred and fifty thousand dollars to the continuing-contract work on Locks and Dams 3 to 7, inclusive; $85,000 to the work of placing Lock 21 in operation, and $10,000 to maintenance of improvement. The funds are needed to make the improvement available for the needs of commerce and for maintaining the channel of the river in a navigable state.

The commerce on the Cumberland River above Nashville for the calendar year 1907, as nearly as could be ascertained, aggregated 241,571 tons, having an estimated value of about $9,914,916; passengers carried, 70,000. The tonnage consisted mainly of timber and farm products and general merchandise.

For references to surveys see page 495, Annual Report of Chief of Engineers, 1906.

July 1, 1907, balance unexpended		$383,355.37
Amount appropriated by sundry civil act approved May 27, 1908		200,000.00
		583,355.37
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$180,363.37	
For maintenance of improvement	3,942.41	
		184,305.78
July 1, 1908, balance unexpended		399,049.59
July 1, 1908, outstanding liabilities		10,802.02
July 1, 1908, balance available		388,247.57
July 1, 1908, amount covered by uncompleted contracts		65,653.25
Amount (estimated) required for completion of existing project		335,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		[a] 345,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix C C 2.)

3. Operating and care of locks and dams on Cumberland River.—Three locks are now in operation on the Cumberland River, viz, Locks A and No. 1, 41.4 and 2.5 miles, respectively, below Nashville, and Lock No. 2, 9 miles above Nashville. Locks A and No. 1 were placed in operation November 26, 1904, and Lock No. 2, October 9, 1907. They have an available length of 280 feet, a clear width of 52 feet between walls, and a depth of 6½ feet on miter sills at low water, except at lower miter sill of Lock A, where the present low-water depth is only 1 foot. This depth will be increased to 6½ feet by the construction of the next lock below.

The first allotment from the indefinite appropriation of July 5, 1884, for the operation and care of these locks was made June 26, 1905.

During the calendar year 1907 the traffic past Lock A was about 79,416 tons; past Lock No. 1, about 80,181 tons; and past Lock No. 2,

[a] Of this amount $250,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907, $85,000 for completing work at Lock No. 21, and $10,000 for maintenance.

since the commencement of its operation in October, 1907, about 15,403 tons.

The amount expended to June 30, 1908, was $29,175.83, of which $16,623.95 was expended during the past fiscal year.

(See Appendix C C 3.)

4. *Caney Fork River, Tennessee.*—This stream lies in the central part of Tennessee. After a course of about 200 miles, wholly in the State, it empties into the Cumberland River at Carthage, Tenn., about 116 miles above Nashville. It is the largest tributary of the Cumberland River.

In its original condition the principal difficulties were found to be rock reefs, gravel and sand bars, and a crooked and shallow channel greatly impeded by surface obstructions.

No work was done by the United States prior to that begun under the present project. The present project, adopted June 14, 1880, is based on the report of 1879, and an extension of the project is based on the report of 1886. It provides for improving the 92 miles of river from Franks Ferry, the head of navigation, to its mouth, Carthage, Tenn., by removing the surface obstructions, building rip-rap dams and training walls, so as to obtain sufficient water for safe navigation during boating season for steamboats drawing not more than 3 feet, at an estimated cost of $45,228. (Annual Report of the Chief of Engineers for 1887, p. 1767.)

Under this project appropriations aggregating $28,000 have been made and $26,466.31 expended to close of the fiscal year ending June 30, 1908.

From August, 1880, when the first work was done, to August, 1891, when the last work was done, $25,000 was expended. The results were an improvement of the channel at a 3-foot stage from Franks Ferry to the mouth of the river. The improvement, however, was not permanent and can not be made so under the present project. The additional work required is therefore practically for maintenance.

No appropriations were made from 1890 to 1905, and no work was done for upwards of 17 years.

The available balance will be expended in clearing the channel of the river of surface obstructions, in accordance with the approved project.

A snagging party with outfit was sent to the head of the river in June to commence the season's work.

In view of the meager benefits resulting, it is not believed that future appropriations are warranted under this project.

The effect of the improvement on freight rates is not believed to be important and can not be readily ascertained.

The commerce on the Caney Fork River for calendar year 1907, as nearly as could be ascertained, aggregated 7,367 tons, having an estimated value of $92,167.

July 1, 1907, balance unexpended	$2,886.70
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,353.01
July 1, 1908, balance unexpended	1,533.69
July 1, 1908, outstanding liabilities	293.50
July 1, 1908, balance available	1,240.19

(See Appendix C C 4.)

5. Removing sunken vessels or craft obstructing or endangering navigation.—An allotment of $800 was made in April, 1906, for removing the wreck of the steamer *Bart E. Linehan*, which sunk in the Cumberland River at Nashville, Tenn. Owing to continued high water its removal was not accomplished until September, 1907. The total cost of removal was $492.10. The balance was deposited in the United States Treasury.

An allotment of $800 was made in August, 1906, for the removal of the wrecked wharf boat *Mayflower*, which was lying in the Cumberland River at Nashville, Tenn., and an emergency contract was entered into October 23, 1906, with R. L. Johnson, of Nashville, Tenn., for its removal. Owing to continued high water the contractor was unable to complete its removal until August 13, 1907. The total expenditures for this work were $700.90. The balance was deposited in the United States Treasury.

(See Appendix C C 5.)

SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in House documents as indicated:

1. Survey of Cumberland River, Tennessee and Kentucky, below Nashville.—Preliminary report dated February 19, 1908, is printed in House Document No. 758, Sixtieth Congress, first session. A plan for constructing Lock B and Lock C at an estimated cost of $562,926 and $696,267, respectively, is presented.

2. Survey of South Fork of Forked Deer River, Tennessee.—Report dated January 22, 1908, is printed in House Document No. 945, Sixtieth Congress, first session. The locality is not deemed worthy of improvement by the United States.

IMPROVEMENT OF RIVERS AND HARBORS IN THE CHATTANOOGA, TENNESSEE, DISTRICT.

This district was in the charge of Maj. Wm. W. Harts, Corps of Engineers, having under his immediate orders First Lieut. W. G. Caples, Corps of Engineers, to October 20, 1907, and Capt. Alfred B. Putnam, Corps of Engineers, since October 18, 1907. Division engineer, Col. E. H. Ruffner, Corps of Engineers, to February 25, 1908, and Col. W. T. Rossell, Corps of Engineers, since that date.

TENNESSEE RIVER SYSTEM.

The Tennessee River is 652 miles long. It is formed by the junction of the French Broad and Holston rivers, 4.5 miles above Knoxville and 188 miles above Chattanooga, and flows into the Ohio at Paducah, 464 miles below Chattanooga. Together with its principal tributaries it forms a system of internal waterways capable of being navigated more than 1,300 miles by steamboats. In addition to this, its tributaries are still further navigable by rafts and flatboats for a distance of more than 1,000 miles, thus making a system of navigable

waters about 2,350 miles in length, with a drainage area of about 44,000 square miles.

The river is navigable the entire year from the mouth to Riverton, Ala. Just above Riverton a lateral canal about 8 miles long is now under construction past the Colbert and Bee Tree shoals, and the Muscle Shoals Canal now surmounts the Big Muscle and Elk River shoals.

Under the act of April 26, 1904, as amended by act of January 7, 1905, a lock and dam to be built mainly by private parties are projected at Hales bar, designed to form a pool extending 33 miles upstream to Chattanooga.

Local boat lines have headquarters at the principal towns along the river. There is no through traffic covering the entire length of the river, the longest regular boat service being found between Chattanooga and Paducah when the stage of water permits.

The amount so far appropriated and allotted for the Tennessee River and the canals thereon is $8,278,431.34. Of this the sum of $1,075,066.49 has been allotted for operating, care, and repair of the Muscle Shoals Canal from November, 1890, when it was opened to navigation, to June 30, 1908.

Freight rates are said to be already considerably lowered by this project, but there is no information available indicating to what extent they will be affected by its completion.

1. Tennessee River.—The improvement has been carried on in three sections under separate appropriations.

(*a*) *Above Chattanooga, Tenn.* (*188 miles*).—In its original condition this part of the river was obstructed by rock reefs, bowlders, gravel bars, and snags. The depth of water on the bars varied from 10 to 30 inches at low water, and in some places the current was as great as 6 miles an hour. The average slope is 0.956 foot per mile, with average low-water discharge varying from about 3,000 cubic feet per second at Knoxville to about 6,000 cubic feet per second at Chattanooga.

The present project, adopted by Congress in act of August 18, 1894, is to obtain by training walls, wing dams, and dredging a low-water channel 3 feet deep from Chattanooga to the mouth of the French Broad River, at an estimated cost of $650,000. Up to June 30, 1895, the sum of $328,255.83 had been expended under a previous project, and there remained 55 obstructions having less than 3 feet depth at low water. A revision of the estimate in 1907, on a basis of present unit prices, places the cost of the existing project at $1,709,000.

The total amount expended under the present project up to June 30, 1908, was $265,847.61, including $12,644.70 for maintenance.

During the past fiscal year work has been carried on at Caney Creek shoals, one of the principal obstructions. For details in this connection, reference is made to Appendix D D 1 of this report.

A wooden-hull steam tender for this work is being built under contract by Ed J. Howard, Jeffersonville, Ind., at a cost of $10,000.

Since beginning the improvement navigation has been materially assisted.

The maximum draft that can be carried at mean low water over the shoalest place in this section is about 18 inches. The extreme flood

oscillations range from about 40.5 feet at Knoxville to about 58 feet at Chattanooga.

The commerce reported on this portion of the river during the calendar year 1907 amounted to about 596,380 tons, valued at about $3,830,790, the principal items in order of value being general merchandise, farm products, forest products, and iron ore.

A map of this section of the river is printed in the Annual Report of the Chief of Engineers for 1876, page 710, and an account of its survey in the report of 1893, page 2333.

It is proposed to apply the amount given as a profitable expenditure in the fiscal year 1910 to maintaining the navigable waterway by the removal of minor channel obstructions and the repair of existing works of regulation, and to continuing improvement under the existing project for the purpose of extending the benefits already secured.

No active operations were carried on in the Little Tennessee River during the fiscal year. The expenditures were on account of necessary travel in the inspection of certain illegally obstructed portions of the river. The obstructions were removed by the persons causing them. The total expenditures for the improvement of the Little Tennessee to June 30, 1908, amounted to $5,510.09. Owing to the slight use made of this tributary, it is believed that further allotments from the appropriations for the upper Tennessee River should not be made for several years. The present condition of the stream is suitable for floating down flatboats and rafts, so that it is not believed that further expenditures are required in the near future. For these reasons no sum is given as a profitable expenditure in the fiscal year 1910.

TENNESSEE RIVER ABOVE CHATTANOOGA.

July 1, 1907, balance unexpended		$101,772.86
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$65,739.83	
For maintenance of improvement	983.62	
		66,723.45
July 1, 1908, balance unexpended		35,049.41
July 1, 1908, outstanding liabilities		8,944.67
July 1, 1908, balance available		26,104.74
July 1, 1908, amount covered by uncompleted contracts		10,000.00
Amount (estimated) required for completion of existing project		1,080,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		110,000.00

LITTLE TENNESSEE RIVER.

July 1, 1907, balance unexpended	$1,611.68
June 30, 1908, amount expended during fiscal year for maintenance of improvement	121.77
July 1, 1908, balance unexpended	1,489.91

(*b*) *Chattanooga, Tenn., to Riverton, Ala.* (*238 miles*).—In its original condition the channel from Chattanooga to Browns Ferry was obstructed by bars, bowlders, reefs, and rocky projections. Navi-

gation was possible during six to nine months annually. Between Browns Ferry and Florence were the Muscle shoals obstructions, which could be crossed only at unusually high water. Between Florence and Riverton the Colbert and Bee Tree shoals prevented navigation for six months in the year.

The average slope is 1.5 feet per mile from Chattanooga to Scott Point (17.5 miles), thence 0.4 foot per mile to head of Muscle Shoals Canal (158 miles), thence 2.73 feet per mile to Riverton (62.5 miles), with average low-water discharge varying from about 6,000 cubic feet per second at Chattanooga to about 10,000 cubic feet per second at Riverton.

Under a former project the Muscle shoals section was improved at a cost of $3,191,726.50 by some channel work at Little Muscle shoals and by the construction of a lateral canal in two divisions, one on the left bank about 3.5 miles long, with 2 locks, around the Elk River shoals, and the other on the right bank, about 14.5 miles long, with 9 locks, around the Big Muscle shoals. This work was done mainly from 1875 to 1890, under a project adopted originally in 1868.

The present project also dates back in part to 1868, but it has been modified in several particulars since then, so that at present it provides for a lock and dam to be built mainly by private parties (under the authority of Congress) at Hales bar, about 33 miles below Chattanooga, forming a pool that will extend to Chattanooga with a depth of at least 6 feet at low water; for open-channel work to secure a depth of 5 feet at low water from Hales bar to Lock A (about 145 miles); and for the improvement of the Colbert and Bee Tree shoals (between Florence and Riverton) by the construction of a lateral canal about 8 miles long, with 1 lock.

There has also been considerable open-channel work under former modifications of the project between Chattanooga and Hales bar and at Colbert and Bee Tree shoals. A revision in 1907 of the estimate for open-channel work on a basis of present unit prices places the cost of additional work required at $1,031,000.

Work under the continuing-contract system is in progress at the Colbert Shoals Canal, as authorized by the river and harbor acts of June 13, 1902, March 3, 1905, and March 2, 1907. The amounts provided for by the first two acts have been appropriated, and of the $213,000 contract authorization carried by the act of 1907 $120,000 is yet to be appropriated. The act of March 2, 1907, also appropriated $62,970 for the completion of the metal work for the Hales Bar lock. (For an account of the contract work at Colbert shoals and Hales bar during the past fiscal year, see Appendix D D 1 of this report.)

The total amount expended under the present project to June 30, 1908, was $2,365,265.10. This expenditure has resulted in the preparation of plans for the Hales Bar lock and dam, the purchase of the metal work to be incorporated in the lock masonry, and the supervision of the entire work, at a total cost of $27,448.54; in the partial improvement of the open-river channel at various points between Chattanooga and Riverton, thereby extending the period of navigation at low water, at a cost of $625,960.60, including $3,048.70 for maintenance, and in the partial construction of the Colbert Shoals Canal, including the practical completion of the masonry of the lock, the purchase of land for right of way, the construction of

19,959 cubic yards, or about 61 per cent, of the concrete river wall, and the excavation of 150,919 cubic yards of rock and 1,448,124 cubic yards of earth and hardpan from the canal trunk, or about 69 per cent of the total excavation, at a total cost of $1,711,855.96.

The Muscle Shoals Canal provides a permanent depth of 5 feet, except in its approaches, where additional work will be required to secure this depth at low water, the improvement never having been fully completed at these points.

The maximum draft that can be carried at mean low water over the shoalest place between Chattanooga and Riverton is about 2 feet. The extreme flood oscillations range from about 69 feet at the Suck, 12 miles below Chattanooga, to about 10 feet at Lock 4 of the Muscle Shoals Canal.

The improvements at Hales bar and Colbert shoals will not be available for navigation until the works are completed.

In the Appendix to this report the district officer recommends that the additional sum of $101,750 be appropriated for completing the part of the work at Hales bar lock with which the United States is chargeable, the funds available for the purpose being insufficient. His recommendation is concurred in, and the accompanying money statement has been prepared accordingly.

It is proposed to apply the amount estimated as a profitable expenditure in the fiscal year 1910 as follows:

At Hales bar, $50,875, in continuing work mentioned in preceding paragraph.

At Colbert and Bee Tree shoals, $120,000, to completion of the canal trunk and placing the canal in operation by the installation of the lock gates, operating machinery, etc., and to necessary contingencies.

For open-channel work, $210,000, to channel excavation and dike construction at shoal places between Chattanooga and Riverton, to providing a suitable working plant for this improvement, and to maintenance of the existing channel.

The commerce carried on the river between Chattanooga and Florence during the calendar year 1907 amounted to about 267,929 tons, valued at about $10,567,000, the principal items, in order of value, being general merchandise, cotton, timber products, and grain.

For references to details of the river from Chattanooga to Riverton, see Annual Report of the Chief of Engineers for 1905, page 456.

HALES BAR LOCK AND DAM.

July 1, 1907, balance unexpended	$104,061.88
June 30, 1908, amount expended during fiscal year for works of improvement	18,522.13
July 1, 1908, balance unexpended	85,539.75
July 1, 1908, outstanding liabilities	14.05
July 1, 1908, balance available	85,525.70
July 1, 1908, amount covered by uncompleted contracts	14,400.00
Amount (estimated) required for completion of existing project	101,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of *June 4, 1897.*	50,875.00

OPEN-CHANNEL WORK.

July 1, 1907, balance unexpended		$206,674.24
Received from sales		24.40
		206,698.64
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$28,474.79	
For maintenance of improvement	1,953.07	
		30,427.86
July 1, 1908, balance unexpended		176,270.78
July 1, 1908, outstanding liabilities		19,695.57
July 1, 1908, balance available		156,575.21
Amount (estimated) required for completion of existing project		1,031,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		210,000.00

COLBERT AND BEE TREE SHOALS.

July 1, 1907, balance unexpended	$583,520.61
Amount appropriated by sundry civil act approved May 27, 1908	93,000.00
	676,520.61
June 30, 1908, amount expended during fiscal year for works of improvement	300,359.87
July 1, 1908, balance unexpended	376,160.74
July 1, 1908, outstanding liabilities	37,808.50
July 1, 1908, balance available	338,352.24
July 1, 1908, amount covered by uncompleted contracts	198,276.16
Amount (estimated) required for completion of existing project	759,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	120,000.00

(*c*) *Below Riverton, Ala. (226 miles)*.—This part of the river is below most of the large tributaries. It has therefore more water than the upper river, and as the width is not too great and the slope uniform and moderate it is accessible to larger boats. The ruling depths were originally about 3.5 feet over the lower 196 miles and 2 feet above this. The average slope of this section of the river is 0.34 foot per mile, with low-water discharge of about 10,000 cubic feet per second. In 1896 there were 49 shoals having less than 5 feet depth at low water, and several other shoals have since developed.

The existing project, adopted March 3, 1899, is to obtain, by dredging, a channel not less than 5 feet deep and 150 feet wide, and to protect Livingston Point and Tennessee Island from erosion, with a view to preserving the port of Paducah, Ky.

The total amount expended to June 30, 1908, was $368,150. This expenditure has resulted in the completion of the work at Livingston Point and Tennessee Island at a cost of $77,367,65; in the removal of snags and the dredging of about 1,127,660 cubic yards of gravel

at about 31 localities, thus removing the worst obstructions below Hamburg; and in the maintenance of floating plant. The results of the dredging operations appear to be fairly permanent at about two-thirds of the places improved. The work done during the season of 1907 has been of unusual value.

The maximum draft that can be carried over the shoalest place in this section at mean low water is about 3 feet. The extreme flood oscillations range from about 48 feet at Johnsonville to about 55 feet at Paducah.

The commerce carried on the river between Florence and Paducah during the calendar year 1907 amounted to about 643,077 tons, valued at about $10,921,250, the principal items, in order of value, being general merchandise, farm products, and timber products.

The amount estimated as a profitable expenditure in the fiscal year 1910 will be applied to maintenance and improvement of the channel at the shoal places offering the greatest obstruction to navigation.

July 1, 1907, balance unexpended		$40,358.75
Collected for damages to dredge *Kentucky*		250.00
		40,608.75
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$9,058.80	
For maintenance of improvement	27,176.42	
		36,235.22
July 1, 1908, balance unexpended		4,373.53
July 1, 1908, outstanding liabilities		8.65
July 1, 1908, balance available		4,364.88
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		50,000.00

(See Appendix D D 1.)

2. Operating and care of Muscle Shoals Canal, Tennessee River.—For details of this canal and of its operation and care, also dimensions of locks, aqueduct, and drift sluice, see pages 2440–2446, Annual Report of the Chief of Engineers for 1901, with corrections given on page 1729 of report for 1902.

The canal was opened to navigation in 1890. It is in two sections, aggregating about 18 miles in length, and has 11 locks. A railroad nearly 15 miles in length is operated in connection with the maintenance of the canal.

Fifteen streams empty into the canal, none of them very large. Bars are constantly forming opposite their mouths and also at the entrances to the canal. A bucket dredge is kept on the canal in order to remove these bars as fast as they form.

The number of commercial steamboats and barges that used the canal during the calendar year 1907 was 588, counting every trip, and the freight carried amounted to about 21,100 tons, the estimated value of which was $1,059,770. The number of lockages, exclusive of those of government craft, was 1,934.

The amount expended to June 30, 1908, is $1,075,066.49, of which $62,961.48 was expended during the year.

(*See Appendix* D D 2.)

3. French Broad and Little Pigeon rivers, Tennessee.—The French Broad River is one of the largest tributaries of the Tennessee. It rises in North Carolina, flows in a generally northwesterly direction, and finally unites with the Holston River in the State of Tennessee, about 4.5 miles above Knoxville, to form the Tennessee River. It has a drainage area of about 5,600 square miles. Leadvale, Tenn., about 70 miles above the mouth, has generally been considered the head of navigation in Tennessee. An isolated portion of the river in North Carolina, between Brevard and Asheville, was under improvement for several years from 1877 to 1882, and $43,000 was expended in removing obstructing bowlders, fish traps, and snags, and in dredging and constructing wing dams at Cherokee, Big Buck, and other shoals.

In its original condition the river was obstructed by rock reefs, sand and gravel bars, and by bowlders, snags, and overhanging trees, and numerous islands in the river divided the water and diminished the depth in the navigable channels. There were 41 shoals obstructing navigation below Leadvale. The average slope below Leadvale is about 2.3 feet per mile, and the low-water discharge at Leadvale is reported as about 2,000 cubic feet per second.

The Little Pigeon River is formed by the junction of its east and south forks at Sevierville, Tenn., and flows in a northerly direction for about 5 miles, emptying into the French Broad about 29 miles above its mouth. The Little Pigeon is navigable at ordinary stages only about 2 miles above its mouth (to Catlettsburg), and thus practically amounts to an additional landing on the French Broad. In its original condition this portion of the river was obstructed by a bar at its mouth.

The present project, adopted June 14, 1880, provides for open-river work on the French Broad to secure a navigable channel at low water from the mouth to Leadvale sufficient to permit the passage of boats drawing about 2.5 feet, at an estimated cost of $150,000, and for the removal of the bar at the mouth of the Little Pigeon.

The amount expended to June 30, 1908, was $96,324.44, of which $5,771.69 was for maintenance. This expenditure has been applied to the improvement of navigation over 15 of the shoal places in the French Broad, the maintenance of the navigable channel, and the removal of the bar at the mouth of the Little Pigeon.

It is proposed to apply the available balance to the improvement and maintenance of the channel.

The maximum draft that can be carried over the shoalest place at mean low water is probably about 18 inches. The extreme flood oscillation is about 30 feet, ordinary floods having a range of about 10 to 15 feet. Steamboats rarely go above Dandridge, 46.5 miles above the mouth, and all the improvements are below this place.

The commerce carried on this river during the calendar year 1907 amounted to about 82,669 tons, valued at about $567,769.

For details of the French Broad, see the report of survey in the Annual Report of the Chief of Engineers for 1900, page 3018. An examination of the Little Pigeon is reported in the Annual Report for 1891, page 2287.

The direction of traffic on these streams is not parallel to rail lines. The effect of the improvement on railroad rates, therefore, would be indeterminate, though doubtless important.

The district officer recommends that owing to the commercial importance of the French Broad River, a biennial appropriation of $10,000 be made for maintenance of the improvement. His recommendation is concurred in. It is also recommended that an appropriation of $18,000 for works of improvement be made for the fiscal year 1910. The appropriation recommended is for the extension of benefits derived by increasing the length of the navigable season.

July 1, 1907, balance unexpended	$4,027.79
June 30, 1908, amount expended during fiscal year for maintenance of improvement	850.27
July 1, 1908, balance unexpended	3,177.52
July 1, 1908, outstanding liabilities	126.19
July 1, 1908, balance available	3,051.33
Amount (estimated) required for completion of existing project	61,515.64
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	28,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix D D 3.)

4. Clinch, Hiwassee, and Holston rivers, Tennessee.—(*a*) *Clinch River.*—This river rises in the Cumberland Mountains in Virginia, and, after following a southwesterly course, empties into the Tennessee River at Kingston, 104 miles above Chattanooga. It drains an area of about 5,000 square miles. Its average slope below Clinton (60 miles from the mouth) is about 1.3 feet per mile. The ordinary low-water discharge at Clinton is about 900 cubic feet per second. There are about 193 miles of the river in the State of Tennessee.

In its original condition the channel was obstructed by rock reefs, sand and gravel bars, bowlders, snags, and overhanging trees.

The present project, adopted in 1880, provides for channel excavation, removing surface obstructions, and the construction of wing dams and training walls, so as to secure a navigable channel 2 feet in depth at ordinary low water from the mouth of the river to Clinton, about 60 miles, and of 1.5 feet in depth from Clinton to Haynes (or Walkers) Ferry, about 66 miles. From Haynes Ferry to the State line, a distance of about 67 miles, it is proposed simply to remove the loose rock and bowlders, reduce the rock ledges, and remove snags, overhanging trees, and similar obstructions, so as to assist raft and flatboat navigation at the stages at which the river is ordinarily used.

The amount expended to June 30, 1908, was $54,298.91, which had resulted in reducing many of the reefs, removing obstructions from the channel, and building several wing dams and training walls, whereby the channel was so far improved that the river could be used at stages 2 to 3 feet lower than before the improvement was begun.

Small steamboats have occasionally navigated the Clinch River as far as Clinton.

The total commerce reported on the Clinch River for the calendar year 1907 was about 94,655 tons (value estimated at $1,552,950). Logs rafted down the river comprised about 70 per cent of this tonnage, and practically all of the remainder was transported between Kingston and the mouth, a distance of less than 1 mile; the only

other traffic reported consisted of about 400 tons of farm products carried between Harriman (near the mouth of Emory River) and Tennessee River points, a distance of 4.5 miles on Clinch River.

For reasons given in his report, the district officer recommends the suspension of appropriations for this stream for the present.

For survey of this river see Annual Report of the Chief of Engineers for 1901, page 2542.

There is no information available indicating the extent to which freight rates are affected by this improvement. It seems safe to say that it will necessarily be slight until the time arrives when changed conditions shall have warranted the adoption of a plan for the radical improvement of this stream.

July 1, 1907, balance unexpended	$1,500.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	972.38
July 1, 1908, balance unexpended	527.62
July 1, 1908, outstanding liabilities	28.84
July 1, 1908, balance available	498.78

(*b*) *Hiwassee River.*—The Hiwassee River rises in the mountains of western North Carolina and northern Georgia, flows in a northwesterly direction, and enters the Tennessee River about 35 miles above Chattanooga. Its largest tributary is the Ocoee River, which enters it from the south about 35 miles from its mouth. The Hiwassee drains an area of about 2,725 square miles. Its average slope below the Ocoee is about 0.93 foot per mile. The low-water discharge at the mouth of the Ocoee is given as about 950 cubic feet per second.

On examination, made in 1874, the channel was found to be obstructed by rock reefs, gravel bars, snags, and overhanging trees.

The original project of improvement, based on the examination of 1874, was for a navigable channel 40 feet wide and 2 feet deep at ordinary low water to Savannah Ford, about 41.6 miles from the mouth of the river, to be secured by excavation of rock reefs and gravel bars and construction of wing dams. Expenditures under this project amounted to $36,427.07.

The present project, based on a survey made in 1899, contemplates the development of a channel of not less than 116 feet width and 30 inches mean depth between the mouth of the river and the mouth of the Ocoee River by use of spur dikes, training walls and submerged sills, bank protection, and dredging, at an estimated cost of $71,125. There were sixteen shoals having less than the desired depth at low water.

This project was adopted by the river and harbor act of June 13, 1902.

The amount expended thereon to June 30, 1908, was $30,599.61. This expenditure was applied to maintenance of the navigable channel and to work of improvement at Mathews and Blackbird shoals, about 9 and 17 miles, respectively, above the mouth.

The maximum draft that can be carried over the shoalest place at mean low water is about 2 feet. The extreme flood oscillation at Charleston, 19 miles above the mouth, is about 32 feet, but ordinary floods do not exceed about 15 to 18 feet. Small boats of about 100 tons capacity can navigate the river eight months in the year. Savannah

Ford, 7 miles above the mouth of the Ocoee River, has at times been reached by steamboats, and is usually regarded as the head of steamboat navigation.

The commerce on the Hiwassee River reported for the calendar year 1907 amounted to about 7,040 tons, valued at about $295,910. It consisted principally of farm products and general merchandise.

For report of survey see Annual Report of the Chief of Engineers for 1901, page 2458.

There is no information available indicating the extent to which freight rates will be affected by this improvement. It will probably be slight.

All the funds called for in the estimate of the present project have been appropriated. In order to maintain the improvement in an effective manner $10,000 should be appropriated biennially for maintenance, and this amount has been estimated for as a profitable expenditure in the fiscal year 1910.

July 1, 1907, balance unexpended	$49,803.24
June 30, 1908, amount expended during fiscal year for works of improvement	10,539.29
July 1, 1908, balance unexpended	39,263.95
July 1, 1908, outstanding liabilities	5,608.30
July 1, 1908, balance available	33,655.65
July 1, 1908, amount covered by uncompleted contracts	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(*c*) *Holston River.*—The Holston River is formed by the junction of its north and south forks at Kingsport, Tenn., and flows thence about 142 miles in a southwesterly direction and unites with the French Broad 4.5 miles above Knoxville to form the Tennessee River. It drains an area of about 3,811 square miles. It has an average slope of about 2.5 feet per mile and a minimum discharge of about 650 cubic feet per second.

In its original condition the channel was obstructed by rock reefs and ledges, bowlders, snags, and overhanging trees. The present project, adopted in 1902, provides for the removal of channel obstructions and cutting overhanging trees from the mouth to Kingsport, at an estimated cost of $5,000.

The amount expended to June 30, 1908, was $5,699.12, which has resulted in clearing the channel of some of the most troublesome obstructions between the mouth and Ridleys shoals, a distance of about 137 miles.

There is no regular upstream navigation of the river. Occasionally a small steamboat runs up 30 to 60 miles from the mouth at times of high water.

The commerce reported for the calendar year 1907 consisted of about 12,240 tons of logs rafted, the value of which was estimated at about $61,200.

For report of survey, see Annual Report of the Chief of Engineers for 1901, page 2518.

Railroad rates are not believed to be at all affected by work carried on under the present project, which is practically for maintenance only.

For reasons given in his report the district officer states that further improvement of this stream is not warranted at the present time.

July 1, 1907, balance unexpended	$1,500.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,181.95
July 1, 1908, balance unexpended	318.05

CONSOLIDATED.

July 1, 1907, balance unexpended	$52,803.24
June 30, 1908, amount expended during fiscal year for maintenance of improvement	12,693.62
July 1, 1908, balance unexpended	40,109.62
July 1, 1908, outstanding liabilities	5,637.14
July 1, 1908, balance available	34,472.48
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a] 10,000.00

(See Appendix D D 4.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of Beech River, Tennessee.—Report dated October 28, 1907, is printed in House Document No. 58, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. Preliminary examination of Big Sandy River, Tennessee.—Report dated October 26, 1907, is printed in House Document No. 217, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

3. Preliminary examination of Richland Creek, Tennessee.—Report dated August 20, 1907, is printed in House Document No. 223, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

4. Preliminary examination of Duck River, Tennessee, from its mouth to Centerville.—Report dated August 20, 1907, is printed in House Document No. 348, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

5. Preliminary examination of Hatchee River, Tennessee, to the town of Brownsville.—Report dated December 23, 1907, is printed in

[a] For Hiwassee River.

House Document No. 666, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

6. Preliminary examination of Elk River, Tennessee and Alabama, from its mouth to Fayetteville.—Report dated November 15, 1907, is printed in House Document No. 951, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

REPORT ON EXAMINATION OF TENNESSEE RIVER AS TO ADVISABILITY OF IMPROVEMENT FOR THE DEVELOPMENT OF WATER POWER, MADE IN COMPLIANCE WITH THE RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Report dated November 7, 1907, by a Board of Engineers on *examination of Tennessee River, from Elk River Shoals to Florence railway bridge, Alabama, as to the advisability of improvement for the development of water power*, required by the river and harbor act of March 2, 1907, was duly submitted, and was transmitted to Congress. It is printed in House Document No. 781, Sixtieth Congress, first session.

IMPROVEMENT OF RIVERS AND HARBORS IN THE FIRST CINCINNATI, OHIO, DISTRICT.

This district was in the charge of Col. Wm. T. Rossell, Corps of Engineers. Division engineer, Col. G. J. Lydecker, Corps of Engineers, to November 15, 1907, Col. Chas. E. L. B. Davis, Corps of Engineers, from November 15, 1907, to February 15, 1908, and Colonel Rossell since February 15, 1908.

1. Ohio River (general open-channel improvement).—This work was commenced by the General Government in 1827, when low-water navigation over many of the bars and shoals was impossible for commercial purposes; but the improvements made and maintained since then have provided fairly convenient channels at such places for a profitable light-draft local freight and passenger service during low-water periods. The difference in level of water surface of the river varies; at Cincinnati, nearly midway between the head and mouth of the river, the average annual range during the past thirty years is 48 feet.

The project under which operations have been carried on has been a continuous and progressive one, the principal features of the work being the removal of snags, rocks, and wrecks from the general channel; the direct improvement of bars and shoals, by dredging and rock excavation; the construction, repair, and maintenance of low dikes and dams to concentrate and direct the flow of water in improved channels; bank protection and the construction and repair of levees where required in the interest of navigation; the construction, repair, and maintenance of ice piers and harbors; miscellaneous improvement, including surveys, establishment, care, and record of water gauges, establishment of harbor lines, regulation of encroachment and deposits on the banks of the river or in its channel, and the supervision of construction of bridges across the river. The length of river through which the work extends is but little short of 1,000 miles, and the total expenditure in this district by the Government during the

eighty-one years it has been in progress, exclusive of liabilities outstanding June 30, 1908, is $6,863,069.12.

The river and harbor act of March 2, 1907, appropriated $20,000 for repairing Great Miami embankment of Ohio River east of Lawrenceburg, Ind., if such repair should be directly and necessarily required in the interest of navigation.

A contract was entered into on December 19, 1907, for repair of this embankment. Owing to the lateness of the season the contractor was not ordered to begin work until May 14, 1908. The following material was placed during the fiscal year: 7,392.5 cubic yards of earth fill and 358⅓ square yards of concrete.

The principal operations of the last fiscal year were as follows: The U. S. dredges *Ohio* and *Oswego* excavated 190,141 cubic yards of gravel, sand, etc., and 92.41 tons of rock and sunken logs, and the hired dredging plant excavated 90,820 cubic yards of gravel, sand, etc., 20 tons sunken logs, and 12,800 feet B. M. wreckage. This dredging has resulted in improvement of the channel, making a depth of 4 to 6 feet below low water at Captina Island bar, Fish Creek Island, Opossum Creek bar, Bat and Grape islands, Short Creek bar, Newberry Island bar, Eightmile Island, Gallipolis Island, Twin Creek bar, and Gallipolis Ice Harbor.

Proposals were solicited twice during the fiscal year for construction of dam at head of Browns Island and both were rejected as excessive, and the work will be readvertised later. A contract was entered into October 14, 1907, for construction of concrete dam at head of Marietta Island, and the work was started on June 10, 1908, the following work being done: Twenty-one piles and 889 cubic yards excavation. A contract was entered into October 14, 1907, for low dike at Grand Chain; river conditions being unfavorable, nothing has been done, but present indications are favorable for its construction during coming low-water season. The work on dikes at Mound City, Ill., is now under contract, but owing to high stages of river which prevailed, no work was done during the fiscal year. Under contract dated June 30, 1905, work on the ice pier at Gallipolis, Ohio, was carried on and completed. The total amount of materials placed in this ice pier was as follows: Timber protection, 14,018 feet B. M.; pumping, twenty-five days; excavation, 797.34 cubic yards; wrought iron or steel, 6,293 pounds; wrought iron or steel nosings, anchors, etc., 7,010 pounds; timber forms, 11,547 feet B. M., and concrete masonry laid, 1,657.21 cubic yards. Work on new hydraulic and grapple dredge and plant has been continued under contract. The hull, cabin, and upper works have been completed, and also the pontons for same.

Supervision was had of established harbor lines at Steubenville, Ohio, Wheeling, W. Va., Ironton, Ohio, and Cincinnati, Ohio. Work in connection with tentative harbor lines at East Liverpool, Ohio, having been completed, the map was platted during the fiscal year. Difficulty having been experienced in locating points in the Cincinnati harbor line on account of removal of buildings, etc., on which they had been placed, a survey party was employed in relocating and marking the harbor line by means of concrete and wooden posts, and tracings are being prepared. Twenty-nine permits were issued by the War Department to cover construction of gas and water pipe

lines, overhead and submarine cables, inclines, waterworks intakes, coal tipples, dredging, bank protection, ice breakers, etc. Plans for rebuilding the superstructure of bridge at Point Pleasant, W. Va., were approved by the Secretary of War. Supervision was had of permits for all miscellaneous and bridge constructions below the Pennsylvania State line.

The nature of the Ohio River is such that its improvement, whether by canalization (locks and dams) or open channel, can not bring full benefit to navigation interests until the improvement shall have become more continuous than past appropriations have permitted. The unimproved portions afford less depth of channel than the improved sections and limit the available draft for the whole river to that required for passing its shoalest parts. Dredging and snagging operations will be required at many places, even should a more or less complete system of canalization be finally adopted, and for open-channel improvement continuous work and simultaneous operations will be absolutely necessary to produce effective results. The Government plant should be largely increased in order that any great amount of work may be accomplished during the comparatively short periods to which effective operations must be limited each year on account of unfavorable river conditions. Several light-draft towboats, barges, and derrick boats for dike construction and removing rocks or other obstructions are all urgently needed before anything approximating satisfactory progress can be expected.

The available depth in the Ohio River varies greatly with the fluctuation in river stages. During the fiscal year the available depth has been above the average. This was due, however, to heavy rainfall rather than to permanent improvement of channel.

The fluctuations in river stages are indicated by the following readings from characteristic river gauges:

	Highest.	1908.	Lowest.	1907.	Range.
	Feet.		*Feet.*		*Feet.*
Pittsburg, Pa., or Davis Island dam [a]	29.1	Feb. 16	3.0	Sept. 1	26.1
Wheeling, W. Va.	42.6	Feb. 17	2.5	Aug. 24	40.1
Parkersburg, W. Va	41.0	Feb. 18	3.8	Sept. 3	37.3
Point Pleasant, W. Va	45.7	Feb. 19	3.1	Oct. 27 Oct. 28	42.6
Portsmouth, Ohio	53.9	Apr. 3	5.3	Oct. 29	48.6
Cincinnati, Ohio	55.7	Apr. 4	7.0	Oct. 31	48.7
Louisville, Ky. (head)	31.2	Apr. 6	3.4	Nov. 1	27.8
Evansville, Ind	42.2	Apr. 8 Apr. 9	3.4	....do...	38.8
Paducah, Ky	42.2	Mar. 20	3.6	....do...	38.6
Cairo, Ill	45.5	Mar. 18 Mar. 19	9.5	....do...	36.0

[a] Pittsburg gauge used when dam was down and Davis Island when dam was up.

The available depth in channel may be considered 1 foot greater than gauge readings from Pittsburg to Louisville and 2 feet greater from Louisville to Cairo.

During the fiscal year no work was done to increase the available depth, but work was confined to the removal of snags and other obstructions and increasing the width of narrow low-water channels, thus bettering navigable conditions.

No estimate can be given of the effect of the improvement thus far made on freight rates. The comparative rates between Pittsburg, Pa., and Memphis, Tenn., by rail and by river were estimated in 1903 as follows:

	Pittsburg-Memphis.	
	Miles.	Per ton.
Soft coal:		
By railroad	807	$3.73
By steamboat	1,218	.42

In this connection reference is made to the Report of Ohio River Board (H. Doc. No. 492, 60th Cong., 1st sess.), in which statements are made of present and prospective commerce and the effects of improvements on freight rates, etc.

In order to provide for navigation during comparatively low-water periods in winter, many of the existing dikes and dams will require to be kept in a state of repair, as the movable dams can not safely be operated during a time of even light-running ice, although properly protected steamboats may be able to navigate at such time. The severe losses to floating craft during recent years have shown the importance of maintaining certain of the harbors of refuge afforded by existing ice piers and the providing of others at carefully selected localities.

The commerce of the river during the past year, so far as indicated by statistics that the engineer officer in charge of the river has been able to obtain, was as follows: General merchandise, coal, etc., 11,306,544 tons, at an estimated value of $79,145,808; passengers, 4,414,213.

July 1, 1907, balance unexpended		$690,043.67
Received from sales, etc		318.91
		690,362.58
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$90,253.74	
For maintenance of improvement	17,415.09	
		107,668.83
July 1, 1908, balance unexpended		582,693.75
July 1, 1908, outstanding liabilities		3,071.89
July 1, 1908, balance available		579,621.86
July 1, 1908, amount covered by uncompleted contracts		173,557.07
Amount (estimated) required for completion of existing project		Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		545,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix E E 1.)

2. Lock and Dam No. 37, Ohio River.—The river and harbor act approved June 13, 1902, authorized the construction of this dam at a cost not to exceed $1,050,000, and the river and harbor act of March

2, 1907, authorized the expenditure of $100,000 in excess of amounts theretofore appropriated or authorized, "provided that the said lock and dam shall be constructed with a view to a navigable depth of nine feet." Of the continuing-contract authorizations $230,000 is yet to be appropriated.

Work was carried on from July 1 to December 15, 1907, and from June 8 to June 30, 1908, with interruptions from eight freshets, and included cofferdam construction, excavation for foundations of lock walls, upper gate recess, upper gate track and section of upper guide wall foundation, construction of lock wall foundations and monoliths, filling back of land wall of lock and around upper and lower gate recesses, the laying of fixed ironwork, lowering gate tracks, clearing of land, constructing lock gates, needles and batterns for poiree dam, wickets for navigable pass, etc., the quantities being as follows: Twenty-four temporary piling; 102,186 feet B. M. crib timbers; clearing 2.7 acres land; 6,148 cubic yards ordinary excavation; 12,171 cubic yards deposit excavation; 307 cubic yards rock excavation; 22,444 cubic yards ordinary filling; 2,306 cubic yards stone filling; 11,314 cubic yards concrete masonry; 2 manholes; 138,455 feet B. M. oak timber; 1,766 feet B. M. white pine timber; 7,752 feet B. M. yellow pine timber; 1,752 feet B. M. cypress timber; 184,507 pounds cast iron; 187,078 pounds wrought iron and steel; 28,548 pounds steel castings; lowering gate track, etc., removing 177 cubic yards concrete masonry.

Under provisions of contract, 218,118 pounds of ironwork, 4,494 feet B. M. oak timber, 7,976 feet B. M. white pine timber, and 13,931 feet B. M. yellow pine timber were delivered at site and partial payment made thereon. Ten thousand six hundred and ninety-nine and one-half barrels of Atlas Portland cement were delivered during the year, and 11,910¼ barrels were used in the work, there being some cement left over from previous year.

By authority of the Secretary of War an additional tract of land, containing 10 acres, was secured on the Kentucky side of the river in order that the river bank might be protected from scour.

Under a supplemental agreement with the contractor dated August 28, 1907, work was carried on in connection with lowering the tracks of the lower gates of lock and slightly modifying the gate itself.

The total expenditures on account of work to June 30, 1908, exclusive of outstanding liabilities, is $450,507.87.

It is proposed to apply the funds asked for the fiscal year 1910 for Lock and Dam No. 37, Ohio River, toward completion of navigable pass, bear traps, buildings, machinery, and other appurtenances of the lock and dam necessary to its operation.

July 1, 1907, balance unexpended	$493,348.48
Amount appropriated by sundry civil act approved May 27, 1908	100,000.00
	593,348.48
June 30, 1908, amount expended during fiscal year for works of improvement	123,856.35
July 1, 1908, balance unexpended	469,492.13
July 1, 1908, outstanding liabilities	2,256.80
July 1, 1908, balance available	467,235.33

July 1, 1908, amount covered by uncompleted contracts	$505,926.15
Amount (estimated) required for completion of existing project	230,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 230,000.00

(See Appendix E E 2.)

3. Operating snag boats on the Ohio River below the Pennsylvania State line.—The condition of the channel way of the Ohio, the necessity for continuous snag-boat work, and the benefits accruing therefrom to river commerce are plainly shown by the yearly reports of obstructions removed, which obstructions, if permitted to remain, would make navigation highly dangerous at ordinary stages and hazardous at any time.

The project for removing obstructions by a properly equipped snag boat was put in operation in 1876, the boat having been completed at a cost of $125,125.24, and the expense of operating having been borne by appropriations for improving Ohio River until 1890. The river and harbor act of September 19, 1890, provided $25,000 yearly for this purpose, and the act of June 3, 1896, increased the yearly appropriation to $50,000.

The amount expended on this work during the fiscal year ending June 30, 1908, was $35,109.69, the total expenditures up to the close of the present fiscal year, exclusive of outstanding liabilities, being $579,133.06. For report upon operation of snag boats on the Ohio River in the State of Pennsylvania, see page 589, following.

As far as practicable the removal of obstructions is carried on whenever permitted by the stage of water and the absence of dangerous ice; and during the last fiscal year the regular Ohio River snag boat *E. A. Woodruff* was in active service from July 1, 1907, to January 4, 1908, and from June 10 to June 30, 1908, traveling 6,251 miles and removing the following obstructions: Seven hundred and ninety-two snags, aggregating 3,542.66 tons; 12 rocks, measuring 170 cubic feet; 364 cords of drift, and 40 wrecks, comprising 17 coal barges, 13 coal boats, 3 fuel flats, 2 gravel barges, 2 mud scows, 1 wharfboat, 1 steam boiler, and the remains of 1 steamboat.

The snag boat *Woodruff* is a powerful and finely equipped vessel that does admirable service during moderate stages of water, but can do little or nothing when the river is at a stage of less than 4 feet, though it is at such stages that snagging operations should be prosecuted most advantageously.

It is extremely important that snagging operations should be extended to cover these low-water periods, and to this end it is recommended that the yearly appropriation for snagging, as provided for by the act of June 3, 1896, be increased to $100,000 for the fiscal year ending June 30, 1910, the additional $50,000 to be used in the building and equipment of one light-draft combination snag and derrick boat, adapted for use at even extreme low-water stages. This

[a] Of this amount $130,000 is under contract authorization of 1902 and $100,000 under that of 1907.

boat would form a part of the regular snagging plant, and would be operated from the yearly appropriation made for that purpose.

(See Appendix E E 3.)

EXAMINATION OF OHIO RIVER MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 3, 1905.

Report dated December 15, 1906, by a Board of Engineers on examination of *Ohio River, with a view to obtaining channel depths of 6 and 9 feet*, respectively, required by the river and harbor act of March 3, 1905, was duly submitted and reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law. The report was transmitted to Congress and printed in House Document No. 492, Sixtieth Congress, first session. Plans for improvement at an estimated cost of $50,962,266 for a 6-foot project and $63,731,488 for a 9-foot project are presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE PITTSBURG, PENNSYLVANIA, DISTRICT.

This district was in the charge of Maj. H. C. Newcomer, Corps of Engineers, having under his immediate orders the following-named officers of the Corps of Engineers: Capt. F. W. Altstaetter to March 30, 1908, First Lieut. E. N. Johnston to August 20, 1907, First Lieut. Lewis M. Adams since December 1, 1907, and Capts. Edward N. Adams and Albert E. Waldron the entire year. Division engineer, Col. G. J. Lydecker, Corps of Engineers, to November 15, 1907, Col. Chas. E. L. B. Davis, Corps of Engineers, from November 15, 1907, to February 15, 1908, and Col. Wm. T. Rossell, Corps of Engineers, since February 15, 1908.

1. Monongahela River, West Virginia.—The Monongahela River is formed by the junction of the Tygarts Valley and West Fork rivers, about 1 mile south of Fairmont, W. Va., and flows in a generally northerly direction about 128 miles to its junction with the Allegheny River at Pittsburg, Pa. The improvement of the portion in West Virginia is considered to extend down the river as far as Lock No. 8 at the mouth of Dunkards Creek, Pennsylvania, about 4 miles north of the Pennsylvania State line, or a total distance of about 41 miles.

Navigation on this portion of the river in its original condition was impeded at high water by swift currents, the fall per mile being about 2 feet. At low stages it was obstructed by shoals and numerous gravel and rock bars. Steamboat navigation was practicable at high stages as far upstream as Morgantown. Occasionally a boat could go as far upstream as Fairmont, and downstream navigation of flats and small rafts was practicable at medium and high stages.

The original project for this portion of the Monongahela River was adopted in 1872, and contemplated the construction of Locks and Dams Nos. 8 and 9. This project was completed on November 8, 1899, with the result that boats drawing 5.2 feet of water could navigate the river at low water as far upstream as Morgantown, W. Va., the river having previously been slack-watered from its mouth to Lock No. 8 by the Monongahela Navigation Company. The amount expended under this project was $436,900.

The existing project, adopted by Congress July 13, 1892, provides for the construction of six locks and dams, Nos. 10 to 15, inclusive, between Morgantown and Fairmont, W. Va., at an estimated cost of $1,275,000. Appropriations aggregating this amount have been made and the sum of $107,463.86 was recovered from surety company on contract of C. I. McDonald for failure to complete Locks and Dams Nos. 10 to 15.

The amount expended under this project up to close of the fiscal year ending June 30, 1908, was $1,314,440.38, including $21.64 received from sales.

The condition of this work on June 30, 1908, was as follows:

Nos. 10 to 15, inclusive.—The locks and dams proper were completed and assigned to "Operating and care of canals," etc., in January, 1904. The lock houses and outbuildings have been completed, the lock grounds graded, and additional protection provided by strengthening the abutments and raising and lengthening the lower guide walls. Some further work is required on one of the abutments and the construction of one upper guide wall.

The completion of these six locks and dams extended slack-water navigation about 28 miles, from Morgantown to a point on the West Fork River 4 miles above Fairmont, W. Va., with a minimum navigable depth of 7 feet. The improvement should enable the people of the territory affected to transport coal, general freight, etc., almost uninterruptedly to market.

The greatest recorded flood height is 40 feet at Morgantown. Ordinary flood heights average about 22 feet on this portion of the river.

Traffic on this portion of the river is not heavy, but it has materially increased over that originally existing there. A daily line of packets plies the river between Pittsburg and Fairmont, and towboats operate as necessity requires. Since the opening of the locks there has been some development of coal mines and the shipment of coal by water in small quantities.

A statement of commerce and of the effect of the project on freight rates, so far as known, is given in the report for operating and care of locks and dams on Monongahela River, page 583.

References to more extended information, reports of surveys, etc., are given on page 467 of the Annual Report of the Chief of Engineers for 1905.

July 1, 1907, balance unexpended	$68,804.05
June 30, 1908, amount expended during fiscal year for works of improvement	758.93
July 1, 1908, balance unexpended	68,045.12

(See Appendix F F 1.)

2. Monongahela River, Pennsylvania.—The improvement of this part of the river is considered to extend from Pittsburg to the mouth of Dunkards Creek, a distance of 87.5 miles. In its original condition, prior to 1840, it was navigable for steamboats only at high stages. A downstream navigation for light-draft flats and rafts was practicable at high and medium stages. The average fall per mile is about 0.9 foot and the minimum discharge about 160 cubic feet per second.

In 1833 Congress provided for a survey of the river from Pittsburg to Brownsville, a distance of about 57 miles. This survey was not

followed by an appropriation for improving the river, and the legislature of Pennsylvania, by act of March 31, 1836, incorporated and authorized the Monongahela Navigation Company to improve the river from Pittsburg, Pa., to the Virginia State line, a distance of 91.5 miles. This company built seven locks and dams, producing slack water from Pittsburg to within 2 miles of the West Virginia State line.

The river and harbor act of June 3, 1896, authorized and directed the Secretary of War to institute and carry to completion proceedings for condemnation of all the property and appurtenances of the company. The property was acquired by the United States on July 7, 1897, at a cost of $3,761,615.46.

The amount expended on original and modified projects prior to operations under existing project was $3,769,073.88, including the purchase money.

The existing project, adopted in 1899, with subsequent modifications (see Annual Report of the Chief of Engineers for 1906, p. 515), provides for the enlargement and improvement of Lock No. 6 and some additional structures at Lock No. 3, for the rebuilding of Locks Nos. 2, 3, and 5, using in each case two parallel chambers, each 56 by 360 feet, and fixed concrete dams with movable tops, and for the acquisition of necessary land and construction of certain improvements at Locks Nos. 5 and 6; all at a total estimated cost of $2,194,605.

The amount expended up to the end of fiscal year ending June 30, 1908, was $1,426,738.58.

Work is being carried on under continuing-contract appropriations at new Lock No. 5. The balance of the authorization remaining to be appropriated is $200,000.

The condition of work on June 30, 1908, was as follows:

Lock and Dam No. 2.—The lock, power house, guard and guide walls, with the exception of upper 105 feet of upper guide wall, were built under contract. The abutment and dam were built by hired labor. The river lock has been in operation since August 15, 1905, and the land lock since March 5, 1906.

The existence of cross currents at this lock renders it necessary to extend the upper guide and guard walls upstream and the middle wall downstream to provide safe and convenient access to the locks, and an estimate of $43,000 is included in this report to cover the cost of the work.

Lock and Dam No. 3.—The lock, guard and guide walls, the power house, power plant, and two lock-keepers' houses were built under contract. The abutment and dam were built by hired labor, the whole work being complete except for the installation of the movable top for the dam and the raising of the upper sill of the river lock. The river lock was placed in operation May 20, 1907, and the land lock October 23, 1907.

Lock and Dam No. 5.—The contractors for the lock have installed their plant and begun work on the upper guard wall and the lower guide wall. Work on the abutment by hired labor has also been begun.

Locks Nos. 3 and 6, and floating plant.—All of the necessary structures at Lock No. 3, and the improvements contemplated at Lock

No. 6 have been nearly completed. All of the floating plant provided for in the existing project, consisting of a dredge and two dump scows and repair steamer with snagging appliances, has been completed and put in service. The necessary land has been acquired at Lock No. 6.

The greatest recorded flood height is 44 feet at Brownsville. Ordinary flood heights average about 30 feet on this portion of the river.

The traffic of the river is hampered and restricted by insufficient capacity and inconvenience at the locks. This will not be overcome until the enlargement of Locks Nos. 1, 4, and 5 has been accomplished.

A statement of commerce and of the effect of the project on freight rates, so far as known, is given in the report for operating and care of locks and dams on Monongahela River, page 583.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to work on new Lock and Dam No. 5 ($200,000), under continuing contract authorized by the river and harbor act of March 2, 1907, and to the extension of upper guide wall upstream and of middle wall downstream at Lock No. 2 ($43,000).

It is very important that old locks Nos. 1 and 4, built many years ago with dimensions that are now inadequate for the growing commerce of the river, and partly in danger of falling down, should be rebuilt at the earliest practicable date, and it is therefore recommended that authorization be also given for the additional amounts required to complete these works, so that they may be carried on under continuing contract.

A list of references to reports of examinations and surveys and other items of interest concerning this river are given on page 469 of Annual Report of the Chief of Engineers for 1905.

CONSOLIDATED.

July 1, 1907, balance unexpended	$368,660.10
Amount appropriated by sundry civil act approved May 27, 1908	300,000.00
Amount received from sale of condemned property	46.55
	668,706.65
June 30, 1908, amount expended during fiscal year for works of improvement	100,536.36
July 1, 1908, balance unexpended	568,170.29
July 1, 1908, outstanding liabilities	10,105.78
July 1, 1908, balance available	558,064.51
July 1, 1908, amount covered by uncompleted contracts	394,994.07
Amount (estimated) required for completion of existing project	243,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 243,000.00

[a] Of this amount, $200,000 is for continuing-contract work on Lock No. 5, authorized by the river and harbor act of March 2, 1907.

REBUILDING LOCK NO. 2.

July 1, 1907, balance unexpended	$3,782.37
June 30, 1908, amount expended during fiscal year for works of improvement	11.95
July 1, 1908, balance unexpended	3,770.42
Amount (estimated) required for completion of existing project	43,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	43,000.00

REBUILDING LOCK NO. 3.

July 1, 1907, balance unexpended	$98,783.74
Amount received from sale of condemned property	46.55
	98,830.29
June 30, 1908, amount expended during fiscal year for works of improvement	79,341.26
July 1, 1908, balance unexpended	19,489.03
July 1, 1908, outstanding liabilities	563.41
July 1, 1908, balance available	18,925.62
July 1, 1908, amount covered by uncompleted contracts	1,291.58

REBUILDING LOCK NO. 5.

July 1, 1907, balance unexpended	$254,440.06
Amount appropriated by sundry civil act, approved May 27, 1908	300,000.00
	554,440.06
June 30, 1908, amount expended during fiscal year for works of improvement	17,033.15
July 1, 1908, balance unexpended	537,406.91
July 1, 1908, outstanding liabilities	9,542.37
July 1, 1908, balance available	527,864.54
July 1, 1908, amount covered by uncompleted contracts	393,702.49
Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	200,000.00

LOCKS NOS. 3 AND 6, ETC.

July 1, 1907, balance unexpended	$3,803.93
July 1, 1908, balance unexpended	3,803.93

LOCKS NOS. 5 AND 6.

July 1, 1907, balance unexpended	$7,850.00
June 30, 1908, amount expended during fiscal year for works of improvement	4,150.00
July 1, 1908, balance unexpended	3 700.00

(See Appendix F F 2.)

3. Operating and care of locks and dams, Monongahela River.—Statements of the original condition of the Monongahela River are contained in the summaries for Monongahela River, West Virginia and Pennsylvania. The slack-water system of the Monongahela River comprises 15 locks and dams. Locks Nos. 1 to 4, inclusive, are double locks; 5 to 15 are single locks. A table giving the dimensions of the locks, lengths of dams, and other data is given in the Annual Report of the Chief of Engineers for 1907, page 1691.

The dams extend slack water to a point on West Fork River 4 miles above Fairmont, W. Va., or a total distance of about 131 miles above the mouth of the Monongahela River at Pittsburg. Controlling depths at normal pool stages on the sills at the different old locks below Morgantown vary from 4 to 6.7 feet; on the new locks above that place they are uniformly 7 feet. During low stages of water depths of 7.5 to 8 feet are maintained below Dam No. 6 by placing flashboards on the dams.

Locks Nos. 1 to 7, inclusive, have been under operation and care since July 7, 1897, when they were purchased from the Monongahela Navigation Company; No. 8 since November 8, 1889; No. 9 since 1879, and Nos. 10 to 15, inclusive, since January, 1904.

The total amount expended for operating and care to June 30, 1908, was $2,443,725.59. The amount expended during the fiscal year ending June 30, 1908, was $253,518.93.

Necessary repairs were made to the locks and dams and floating plant, and the locks were operated throughout the year, except when closed for limited periods for repairs, or on account of floods or ice.

The total number of lockages at the 15 locks for the calendar year 1907 aggregated 88,115, giving a total commerce through individual locks amounting to 36,768,381 tons, and 223,408 passengers. Much of this commerce, of course, moved through several locks. Taking only the aggregate of the greatest items of the different kinds of freight passing up and down at any single lock, plus the coal mined and shipped in pools 1 and 2, which amount is manifestly less than the real movement of commerce, the total commerce of the Monongahela River for the year amounted to 12,772,508 tons and 42,373 passengers.

The effect on freight rates of the slack-water system of the Monongahela is very great. This is true for all manner of products, and particularly so for coal. For an average haul of 50 miles on the Monongahela River the price of coal delivered by river is $1.25 per ton, as compared with $1.40 per ton delivered by rail, making the river freight rate 15 cents per ton cheaper. As the haul increases the advantage of the river advances rapidly. As an example, the river freight rate on coal to a point 12 miles below Pittsburg is 2.5 mills per bushel, or 6.25 cents per ton, in barge-load lots, while the rail freight rate to the same point is 40 cents per ton, a difference in favor of river of 33.75 cents per ton. The effect on freight rates beyond the above, due to the rebuilding of Locks and Dams 2 and 3, will not be felt until the enlargement of Locks Nos. 1, 4, and 5 is accomplished, when larger cargoes will be towed by steamers and the freight rate reduced accordingly.

(See Appendix F F 3.)

4. Allegheny River, Pennsylvania, open-channel work.—The Allegheny River rises in northern Pennsylvania and flows northwestward

into New York, and thence in a southerly direction into Pennsylvania again to its junction with the Monongahela River at Pittsburg. The average fall per mile of the navigable portion is about 2.2 feet and the minimum discharge at Pittsburg is about 1,440 cubic feet per second. In its original condition the Allegheny River abounded in obstructions, such as bowlders, snags, islands, bars, and wide-spreading shoals, all of which rendered navigation at best hazardous and practicable only at such high stages of water as would enable craft to clear the obstructions.

The present project was adopted in 1878 and 1880 and contemplates the removal of the bowlders and snag obstructions and the construction of low dams and dikes to close secondary channels and concentrate the low-water flow on shoals.

The amount expended under this project to June 30, 1908, was $262,709.20, fully one-half of which was applied to maintenance.

The work that has been done enables navigators to operate safely on stages from 2 to 3 feet lower than formerly.

The present condition of the channel is generally satisfactory, having been largely cleared of the more objectionable obstructions, but to maintain its condition it is necessary to annually remove any bowlders or snags brought in by the tributaries or carried along by ice and freshets. The dikes and dams are also becoming old and require frequent repairs.

The greatest recorded flood height is 36.6 feet at Herr Island dam. Ordinary flood heights average about 30 feet.

Except on the lower 25 miles of the river the principal traffic is the downstream transportation of timber and lumber rafts, new coal-boat bottoms, barges and flats, usually loaded with tan bark, lumber, posts, railroad ties, and other timber products, and the towage of gravel, stone, sand, etc. Steamboating is not now conducted to any material extent above Kittanning.

The annual commerce of the river above slack-water improvements in course of construction is about 400,000 tons, extending over 230 miles from Tarentum, Pa., to Olean, N. Y.

The effect of the work on freight rates is not very noticeable, as the depth of water has not been increased, but the hazard of boating has been greatly decreased.

It is proposed to apply the $5,000 estimated as a profitable expenditure for the fiscal year 1910 to maintenance of the existing channel and works of improvement.

More detailed information, reports of surveys, etc., are given in the following Annual Reports of the Chief of Engineers: 1899, page 2411; 1902, page 1901, and 1905, page 1862.

July 1, 1907, balance unexpended	$2,891.08
June 30, 1908, amount expended during fiscal year for maintenance of improvement	600.28
July 1, 1908, balance unexpended	2,290.80
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix F F 4.)

5. Allegheny River, Pennsylvania, construction of locks and dams.—Prior to the completion, in 1885, of the Davis Island dam in the Ohio River, 5 miles below its head, it was impossible to navigate the Allegheny River with steam craft of lightest draft during low-water periods, which frequently continued for months at a time. Since then a navigable depth of 8 feet has been afforded by that dam, when raised, to Garrison ripple, 2 miles up the stream.

The present project for lock and dam construction, originally adopted in 1890 and subsequently extended in 1896, provides for the construction of three locks and dams, extending slack water from the mouth to Tarentum, a distance of 25 miles. Dam No. 1 is movable, of Chanoine type, with bear-trap weirs. Dams Nos. 2 and 3 are both fixed, the former being built of concrete on pile foundation and the latter of crib construction. The lock chamber at No. 1 is 55 feet by 286 feet 2 inches; at Nos. 2 and 3, 56 feet by 289 feet 6 inches. The estimated cost of the work is $1,658,226.63, including $10,000 for restoration of bank, etc., below Dam No. 3. In addition $110,300 will be required to cover the restoration of bank at Dam No. 3, made necessary by the flood of 1907, and the payment of damages to private property resulting from the failure of the abutment.

The amount expended to June 30, 1908, was $1,561,958.99; of this amount $10,000 was expended for maintenance.

The work is being done partly under continuing contract, and the total authorization has been appropriated.

The condition of the work on June 30, 1908, was as follows:

Lock and Dam No. 1 (Herr Island), about 1½ miles from the mouth.—This work was built under contract and has been in operation since January 1, 1903.

The dam was first raised June 2, 1903. One double lock-masters' house has been built under contract.

Lock and Dam No. 2 (Aspinwall), 7 miles from the mouth.—The lock has been built under contract and has been in operation since November 10, 1906. The abutment and dam have been partially built under contract. It is expected that they will be completed during the present season.

Lock and Dam No. 3 (Springdale), about 17 miles from the mouth.—The lock was built under contract and has been in operation since September, 1904. The abutment and dam were built under contract. In January, 1907, during a moderate flood stage, the abutment failed and a portion of the dam had to be blown up to limit the resulting damage to private property.

The abutment has been rebuilt and it is expected that the dam will be restored during the present season. Two lock houses have been built under contract.

Pool No. 1 provides a navigable depth of 5 to 6 feet. Dams Nos. 2 and 3 must be completed before any appreciable increase of depth will be obtained in their respective pools.

The greatest recorded flood height is 36.6 feet at Herr Island dam. Ordinary flood heights average about 30 feet.

For the calendar year 1907 the commerce reported on that part of the river under the improvement for slack-water navigation was 900,202 tons of freight and 4,614 passengers.

The completion of these locks and dams will be of immense benefit to the manufacturing plants along the banks of the Allegheny River

within their reach, by reason of connecting them with the harbor of Pittsburg and with the coal fields of the Monongahela River.

The effect of the project on freight rates is given in report on operating and care of locks and dams on Allegheny River.

In addition to the funds appropriated by the river and harbor act of March 2, 1907, for repair and reconstruction of Dam No. 3, an estimate of $110,300 is submitted by the district officer as the further amount required for restoration of the bank at the abutment of Dam No. 3 and for the payment of damages to private property resulting from the failure of the abutment in January, 1907. All of the claimants except two, with whom satisfactory agreements could not be made and whose claims, estimated at $365.25, have not been included, have signed agreements binding themselves to accept reasonable sums in full payment of their claims. These amounts aggregate $44,138.88, and the remaining $66,161.12 is needed to restore land that was washed away. An appropriation of the amount ($110,300) required for this purpose is recommended for the favorable consideration of Congress.

July 1, 1907, balance unexpended	$310,527.78
Amount received from sale of blueprint maps	25.85
	310,553.63
June 30, 1908, amount expended during fiscal year for works of improvement	214,089.44
July 1, 1908, balance unexpended	96,464.19
July 1, 1908, outstanding liabilities	12,180.08
July 1, 1908, balance available	84,284.11
July 1, 1908, amount covered by uncompleted contracts	46,694.15

(See Appendix F F 5.)

6. Operating and care of locks and dams, Allegheny River, Pennsylvania.—Statement of the original condition of the Allegheny River is contained in the preceding summary for Allegheny River, Pennsylvania.

Locks Nos. 1, 2, and 3 were under the appropriation for operating and care at the end of the fiscal year. Dimensions of locks and other data are given in Annual Report of the Chief of Engineers for 1907, page 1705.

Dam No. 1 is movable and is the first to be completed in a series of three authorized by Congress for the Allegheny River; its pool provides a navigable depth of 5 to 6 feet for a distance of about 5.5 miles. Dams Nos. 2 and 3 are both fixed, the former being built of concrete on pile foundation and the latter of crib construction. Dam No. 2 is only partially completed; when finished it will form a pool about 10 miles long. Dam No. 3 was practically completed in 1904, but was partly destroyed in January, 1907; its pool, when restored, will extend slack water to Natrona, a distance of about 8 miles.

Lock No. 1 has been under operating and care since January 1, 1903; No. 2 since November 10, 1906, and No. 3 since November 29, 1904.

The total amount expended for operating and care to June 30, 1908, was $219,710.29. The amount expended during fiscal year 1908 was $61,574.93.

The locks and dams were operated throughout the year as occasion required.

The traffic through locks and dams, Allegheny River, during the calendar year 1907 was as follows: Lock and Dam 1, 443,109 tons and 2,367 passengers; Lock and Dam 2, 428,309 tons and 513 passengers; Lock and Dam 3, 28,784 tons and 1,734 passengers. The tons represent short tons of 2,000 pounds.

The operation of the locks and dams on the Allegheny River, providing a system of slack-water navigation in connection with Pittsburg Harbor, will tend to give manufacturing plants in this section the benefit of the cheap river rates on coal and other supplies. This benefit, however, can not be realized to any considerable extent until the low bridges on the lower Allegheny River are raised sufficiently to remove the very serious obstruction to navigation that they now present.

(See Appendix F F 6.)

7. Construction of locks and dams in Ohio River, Pennsylvania (40.5 miles).—The Ohio River, Pennsylvania, in its original condition had a low-water channel depth varying from 1 foot at Pittsburg to 2 feet at the Ohio State line, the average slope being about 1.25 feet per mile and the minimum discharge at the head about 1,600 cubic feet per second. Under the original project for open-river improvement, work was conducted on this portion of the river at a number of shoals.

Under the original project for lock and dam construction, adopted in 1875, Dam No. 1 was begun in 1877 and completed in 1885, at a cost of $940,000. The present project, in its original form, was adopted by Congress September 19, 1890, and, with subsequent modifications, provides for the construction of Locks and movable Dams Nos. 2, 3, 4, 5, 6, and 7, so as to secure a navigable depth of 9 feet in the pools formed thereby, the locks to have available dimensions of 110 by 600 feet, at a total estimated cost of $6,321,376. Appropriations aggregating $5,369,376 have been made, and $15,684.74 has been realized from other sources. The sum of $75,000 additional will be required to place the grounds at Locks Nos. 2–5 in suitable condition.

The amount expended under present project to the close of the fiscal year ending June 30, 1908, was $5,353,316.33.

The work was done partly under continuing-contract system, and the total authorization has been appropriated.

The condition of work on June 30, 1908, was as follows:

Locks and Dams 2, 3, 4, 5, and 6 were all practically completed. The dams were first raised on the following dates: No. 1, October 7, 1885; No. 2, November 12, 1906; No. 3, June 25, 1908; No. 4, June 30, 1908; No. 5, November 21, 1907; No. 6, August 17, 1904.

Lock and Dam No. 7.—The site for this work has been secured, and plans are in course of preparation. No field work of construction has been done on account of lack of funds.

The completed dams, Nos. 1–6, inclusive, give continuous slack water, when raised, from Pittsburg to Merrill, Pa., a distance of about 28.9 miles.

The greatest recorded flood height is 34.2 feet at Davis Island dam. Ordinary flood heights average about 28 feet on this portion of the river.

A statement of commerce and of the effect of the project on freight rates, so far as known, is given in the report for operating and care of locks and dams, Ohio River, page 590.

It is proposed to apply the $75,000 estimated as a profitable expenditure for the fiscal year 1910 to the completion of necessary work on the lock grounds at Locks 2, 3, 4, and 5. This includes necessary filling in the lock grounds, which are now very much below grade, and the construction of concrete paving.

Reference to more detailed information, reports of surveys, etc., are given on page 522 of the Annual Report of the Chief of Engineers for 1906.

CONSOLIDATED.

July 1, 1907, balance unexpended	$533,275.64
Amount received from sale of condemned property	439.29
Amount received from sale of blueprint maps	11.85
Refundment of overpayment	.10
	533,726.88
June 30, 1908, amount expended during fiscal year for works of improvement	501,982.43
July 1, 1908, balance unexpended	31,744.45
July 1, 1908, outstanding liabilities	221.88
July 1, 1908, balance available	31,522.57
Amount (estimated) required for completion of existing project	1,027,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	75,000.00

DAMS NOS 2, 3, 4, AND 5.

July 1, 1907, balance unexpended	$454,749.62
Amount received from sale of condemned property	422.94
Amount received from sale of blueprint maps	11.85
Refundment of overpayment	.10
	455,184.51
June 30, 1908, amount expended during fiscal year for works of improvement	436,264.74
July 1, 1908, balance unexpended	18,919.77
July 1, 1908, outstanding liabilities	221.88
July 1, 1908, balance available	18,697.89
Amount (estimated) required for completion of existing project	75,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	75,000.00

DAM NO. 6.

July 1, 1907, balance unexpended	$72,453.29
Amount received from sale of condemned property	16.35
	72,469.64
June 30, 1908, amount expended during fiscal year for works of improvement	64,400.34
July 1, 1908, balance unexpended	8,069.30

DAM NO. 7.

July 1, 1907, balance unexpended	$6,072.73
June 30, 1908, amount expended during fiscal year for works of improvement	1,317.35
July 1, 1908, balance unexpended	4,755.38
Amount (estimated) required for completion of existing project	[a] 952,000.00

(See Appendix F F 7.)

8. Dredging Ohio River, Pennsylvania.—An allotment of $20,800 was made June 12, 1905, from the appropriation of $300,000 made by act of March 3, 1905, for the general improvement of the Ohio River, for the removal of the bar in upper approach to Lock No. 6. This bar was removed by the excavation of 35,161 cubic yards of material at a contract cost of 19 cents per cubic yard. On August 30, 1905, a reallotment of $10,350 from the allotment for dredging pool No. 6 was made for dredging in pools Nos. 3 and 4, Ohio River. Under this allotment the channel at Whites riffle, above Lock No. 3, was straightened out. The total amount of material handled was 36,162 cubic yards.

The amounts expended on these works to June 30, 1908, are as follows:

Dredging pools Nos. 3 and 4	$4,941.45
Dredging pool No. 6	8,693.16
Total	13,634.61
July 1, 1907, balance unexpended	$4,665.39
July 1, 1908, balance unexpended	4,665.39

(See Appendix F F 8.)

9. Operating snag boats on Ohio River in the State of Pennsylvania.—The project adopted July 27, 1905, provides for the removal of snags, wrecks, and similar obstructions in portion of the Ohio River in the State of Pennsylvania. This work was carried on under allotments made from the permanent appropriation for operating snag boats on Ohio River.

The amount expended on this work to June 30, 1908, is $5,068.94, of which $1,953.71 was expended during the past fiscal year.

There were removed during the year two coal barges, two fuel flats, and two snags.

(See Appendix F F 9.)

10. Operating and care of locks and dams, Ohio River, Pennsylvania.—Statement of the original condition of the Ohio River is contained in the summary for Ohio River, Pennsylvania, page 587.

[a] For 6-foot project.

Locks and Dams 1 to 6, inclusive, were under the appropriation for operating and care at the end of the fiscal year. The dams are all movable and are the first ones to be completed in the series that is projected for the improvement of the Ohio River. The dimensions of the locks, with other data, are given in Annual Report for 1907, page 1715 et seq.

Dam 1, at Davis Island, was designed to give a depth of 6 feet in Pittsburg Harbor, which has since been increased to 10 feet over certain portions of the harbor by dredging. Dams 2 to 6, inclusive, are designed to give navigable depths of 9 feet in their respective pools. The aggregate length of these pooled portions of the river is 28.9 miles.

These locks and dams were placed under operating and care, as follows: No. 1, October 7, 1885; No. 2, October 13, 1906; No. 3, February 1, 1908; No. 4, February 1, 1908; No. 5, November 21, 1907; No. 6, August 3, 1904.

The total amount expended for operating and care to June 30, 1908, was $666,009.18. The amount expended during the fiscal year ending June 30, 1908, was $78,700.21.

Dam 1 was up during the fiscal year 10 times, aggregating one hundred and twenty-four days; Dam 2, 8 times, ninety-two days; Dam 3, 1 time, ten days; Dam 4, 1 time, one day; Dam 5, 2 times, twenty-three days; Dam 6, 2 times, twenty-three days.

The locks were operated as occasion required and necessary repairs made for maintenance of the works.

The traffic for the calendar year 1907, as measured by the commerce through Lock and Dam 1, amounted to 4,021,806 tons of 2,000 pounds.

The effect of the project on freight rates has been partly discussed in the report for operating and care of locks and dams, Monongahela River.

Davis Island dam, forming as it does the pool of Pittsburg Harbor, has lent its great part to the general effect on freight rates to and from Pittsburg. The effect on rates of the operation of Dams 2 to 6, inclusive, should be felt locally for all supplies coming from Pittsburg Harbor, and to some extent also for through traffic, since they will increase from 25 to 50 per cent the number of days in the year on which tows may be moved down the river from Pittsburg.

The great future benefit of the above project will be felt only when the slack-water system is extended far enough down the Ohio River to permit continuous navigation during all but the winter season. This improvement it has been estimated will cause a saving in freight rates over the present rail rates on such produce as coal, iron, steel, sugar, timber, molasses, tobacco, etc., of over 3 mills per ton-mile to the 8,000,000 people living in territory commercially contiguous to the Ohio and Mississippi systems.

(See Appendix F F 10.)

11. Harbor at Pittsburg, Pa.—This harbor comprises that portion of the Ohio River lying above Davis Island dam, a length of 4.7 miles; that portion of the Allegheny River lying between its mouth and Aspinwall, a length of 7 miles, and that portion of the Monongahela River lying between its mouth and McKeesport, a distance of 15.5 miles; total length of harbor, 27.2 miles. That portion of the harbor most used as such, and called the lower harbor, lies between

the Davis Island dam and Dams No. 1 on the Allegheny and Monongahela rivers and measures 8 miles of river. In its original condition the lower harbor depths were from 3 to 4 feet on natural mean low river, and very often still lower stages caused suspension of navigation.

Since the completion of Davis Island dam, in 1885, the maximum draft which could be carried over the shoalest place was scant 8 feet at pool stage. Parts of the channel and harbor are from 10 to 12 and from 16 to 20 feet in depth. The average widths of the harbor at pool-full surfaces are: On the Ohio, about 1,100 feet; on the Allegheny, about 930 feet, and at different parts of the Monongahela, from 750 to 950 feet. The capacity of the harbor is impaired by shoal places and high dumps projecting from the banks. The use for harbor purposes of that portion of the harbor in the Allegheny River above the Sixth Street Bridge is practically nullified by the low bridges on that part of the stream. The clear heights of these bridges above their respective pool surfaces are from 27½ to 35½ feet. The least height, with chimneys down, of the packets that ply between Pittsburg and points on the Ohio, Kanawha, and Muskingum rivers is 45 feet. The average height of the Ohio River towboats, with chimneys down, is 44 feet. The height of a suitable packet for the Allegheny River is about 33 feet, and of a suitable towboat, about 28 feet. The result is that practically none of the coal and iron or steel products intended for southern shipments have been loaded or harbored in the Allegheny River. The removal of the Union Bridge at the mouth of the river has opened up this portion of the harbor as far as the Sixth Street Bridge, a distance of about one-half mile.

In 1858 the State of Pennsylvania, through a board of commissioners, made a detailed survey of the rivers at and near Pittsburg and laid down on the maps high and low water lines intended to define the banks and limit the use of the same by riparian proprietors. These lines were referred to stone monuments on the ground. No means, however, were provided for preserving the monuments nor for preventing filling in the river beyond these lines.

In 1894 a Board of Engineer officers recommended certain harbor lines for the harbor of Pittsburg, from the Davis Island dam to Brilliant, Allegheny River, and to Homestead, Monongahela River. The recommended lines generally followed the actual banks as they existed at that time. These lines were approved by the Secretary of War January 29, 1895. An extension of these lines on the Monongahela River from Homestead to McKeesport was approved by the Secretary of War April 3, 1902.

The original project for improvement was adopted by the river and harbor act of March 3, 1899, and provided, with subsequent modifications made during the progress of the work, for dredging a channel through the lower harbor (below Dams No. 1 on the Allegheny and Monongahela rivers) where needed 10 feet deep at pool and 500 feet wide below Smithfield Street Bridge, Monongahela River. and of less width above this bridge and in the Allegheny River, limited by lines from ends of channel spans of the adjoining bridges, except at the Pan Handle railroad bridge, where the dredged channel, under modified project, was to have a width of 570 feet, including two channel spans; for raising the old riprap dam across Brunot Island back channel, Ohio River; for removing abandoned structures and

unauthorized and obstructive fillings projecting from the banks beyond the harbor lines; for marking of harbor lines, and for inspecting and patrolling the harbor. Appropriations aggregating $110,662.90 were made and expended on this work.

The existing project provides for maintenance of the harbor at an annual estimated cost of $10,000. The amount expended under this project to June 30, 1908, was $37,145.35.

The greatest recorded flood height is 35.5 feet at Pittsburg. Ordinary flood heights average about 24 feet.

The principal commercial uses of the harbor are the mooring of coal fleets awaiting a rise in the Ohio for proceeding to destination on that river or on the lower Mississippi, the mooring of timber rafts and boat bottoms coming down the Allegheny River on rises, the delivery of coal and other materials to mills, furnaces, steel plants and yards, and the accommodation of the several packet lines plying on the three rivers and whose routes terminate at the harbor. Besides coal, considerable quantities of steel rails, cotton ties, sheet iron, wire, nails, etc., are shipped by barges to the lower river markets.

Commercial statistics.

Calendar year.	Products.	Passengers.	Calendar year.	Products.	Passengers.
	Tons.a			*Tons.a*	
1900	8,141,451	884,415	1904	9,378,448	604,477
1901	10,916,489	817,800	1905	12,269,020	608,716
1902	12,252,405	996,500	1906	12,927,975	271,450
1903	12,240,360	702,269	1907	14,396,816	532,280

a 2,000 pounds.

The improvement of this harbor is so closely connected with the slack-water system of the rivers emptying into it that it might well be said that, as far as effect on freight rates is concerned, this project is one and the same as the projects for the improvement of said rivers.

It is proposed to apply the $10,000 estimated as a profitable expenditure for the fiscal year 1910 to the maintenance of the harbor in accordance with the approved project.

References to reports of establishment of harbor lines and projects for maintaining this harbor are given in Annual Reports of the Chief of Engineers for 1905, page 474, and 1906, page 520.

July 1, 1907, balance unexpended	$5,612.25
Amount received from sale of blueprint maps	26.15
	5,638.40
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,736.71
July 1, 1908, balance unexpended	1,901.69
July 1, 1908, outstanding liabilities	475.90
July 1, 1908, balance available	1,425.79
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix F F 11.)

EXAMINATIONS MADE IN COMPLIANCE WITH THE RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of Deckers Creek, West Virginia.—Report dated October 4, 1907, is printed in House Document No. 57, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. Preliminary examination of Cheat River, West Virginia.—Report dated October 7, 1907, is printed in House Document No. 216, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

3. Preliminary examination of Youghiogheny River to Connellsville, Pa.—Report dated October 10, 1907, is printed in House Document No. 330, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

IMPROVEMENT OF RIVERS AND HARBORS IN THE WHEELING, WEST VIRGINIA, DISTRICT.

This district was in the charge of Capt. F. C. Boggs, Corps of Engineers, to April 1, 1908, and of Capt. F. W. Altstaetter, Corps of Engineers, since that date. Division engineer, Col. G. J. Lydecker, Corps of Engineers, to November 15, 1907, Col. Chas. E. L. B. Davis, Corps of Engineers, from November 15, 1907, to February 15, 1908, and Col. Wm. T. Rossell, Corps of Engineers, since February 15, 1908.

1. Locks and dams in Ohio River between the Pennsylvania State line and Cincinnati.—A general description of the Ohio River is contained in the Annual Report of the Chief of Engineers for 1896, page 2062. The system of improvement of this river by movable dams was approved by Congress in the act of March 3, 1875 (construction of dam at Davis Island—first dam below Pittsburg). The act of September 19, 1890, provided for the construction of a dam at or near Beaver, Pa., known as No. 6. The above represented practically the original projects for the slack-water system of the Ohio. The original project for Dams Nos. 8 to 18, inclusive, is contained in Annual Report of the Chief of Engineers for 1899, page 2361, and that for Dams Nos. 19 and 26 in Annual Report of the Chief of Engineers for 1902, page 1867.

Congress, in the river and harbor act of March 3, 1905, made provision for 9-foot navigation in the pools formed by Dams Nos. 2, 3, 4, 5, and 6, and for an examination of and report on the river by a Board of Engineers with regard to the method and means of improvement which will meet the demands of traffic, present and prospective. This report is contained in House Document No. 492, Sixtieth Congress, first session.

The river and harbor act of March 2, 1907, made provision for a navigable depth of 9 feet at Dams Nos. 8, 11, 13, 18, and 26, and for increased cost as follows: Dam No. 8, $1,211,845; Dam No. 11, $1,158,343; Dam No. 13, $1,286,778; Dam No. 18, $933,000; and Dam No. 26, $1,200,000. The increased depth at Dam No. 19 has not been authorized and the estimate of cost remains at $950,000.

When the dams are completed they will provide a navigable depth of 9 feet at intervals between Pittsburg, Pa., and Gallipolis, Ohio.

Continuing contracts have been authorized for carrying on the following works, the balance of the authorization remaining to be appropriated being set opposite:

Dam No. 8	$364,000
Dam No. 11	300,000
Dams Nos. 13 and 18	395,000
Dam No. 26	855,000

The following is a statement of the condition of the works:

Dam No. 8.—The masonry for the lock and guide walls was completed, esplanade paved, and a contract entered into for building 700 feet of navigable pass for dam. Work on the pass was commenced in April. Plans for the remaining section of dam were in preparation. The lock, as built, will meet the requirements of 9-foot navigation. About 35 per cent of the work required at this site is completed.

Dam No. 11.—Work on the masonry for lock and guide walls progressed rather slowly. The raising of the walls to provide for 9-foot navigation was commenced last year, but not finished. The following is a statement of the finished sections: 600 linear feet of land wall, 315 linear feet of river wall, 50 linear feet of lower guide wall, the lower gate-recess walls, and practically all underwater work. Not over 70 per cent of the work contracted for is completed.

A contract was entered into for building 700 feet of navigable pass for dam. The contractors began work on the pass in April.

Dam No. 13.—The masonry for the lock and part of the guide walls is completed.

A contract was entered into for completing the guide walls, and work on foundation for upper guide wall was begun. Under this contract the power-house foundation was completed and the paving of the esplanade commenced.

Good progress was made on the dam, the following parts having been completed: 582 linear feet of navigable pass, foundations for bear traps, both piers, abutment, and retaining wall. Fully 65 per cent of the work contracted for is completed.

Plans for lock gates and power house and the necessary specifications for canvassing bids were prepared.

Dam No. 18.—Masonry of lock and guide walls and filling of esplanade are completed.

After a rather disastrous season last year the receiver for the contractor abandoned the construction of the dam; the contract was annulled, and the work will be completed by hired labor. Preparations were made in May and actual operations begun in June. At the close of the fiscal year the parts completed were as follows: 635 linear feet of navigable-pass foundation, abutment, foundation for

east bear trap, Pier C, and 30 linear feet of foundation for weir. About 60 per cent of the dam is completed.

Dredging necessary at this site is being done under contract.

Plans for lock gates, power house, and lock house were completed, and the necessary specifications prepared.

Dam No. 19.—The location for the lock was changed to the West Virginia side, as better foundation material was found there. Plans for abutment and power house and the necessary specifications were prepared.

Dam No. 26.—The survey for the site was completed and negotiations entered into for the land required. To hasten work at this site the abutment will be built by hired labor. Work had begun at the close of the fiscal year. Plans and specifications for power house and lock houses were prepared.

The conditions for construction work were not favorable on this stretch of river during the fiscal year. There were frequent rains and much high water.

The amount expended on the above works to June 30, 1908, is as follows:

Dam No. 8	$491,012.46
Dam No. 11	346,986.75
Dam No. 13	732,776.06
Dam No. 18	539,351.67
Dam No. 19	18,871.32
Dam No. 26	18,974.07
Total	2,147,072.33

The canalization of this section of the river is not far enough advanced to benefit navigation and therefore has had no effect on freight rates.

For commercial statistics, see reports for improving Ohio River and operating and care of Davis Island Dam.

To obtain the best results sufficient funds should be made available for carrying on the work without interruption.

At No. 8.—Funds for the completion of the dam and construction of lock gates and buildings should be provided.

At No. 11.—Sufficient funds should be made available for the completion of dam and construction of lock gates and buildings.

At No. 13.—Work is in condition for early completion and funds should be made available therefor.

At No. 18.—Conditions are favorable for early completion of structures at this site and funds should be made available for the purpose.

At No. 26.—The funds are required for completing lock and part of dam.

It is deemed advisable that provision should be made for the necessary surveys to locate sites and for acquisition of land required for additional locks and dams to be constructed under the adopted project in order to avoid delays incident to such work after appropriations for actual construction have been made.

DAM NO. 8.

July 1, 1907, balance unexpended	$306,495.86
Amount appropriated by sundry civil act approved May 27, 1908	136,000.00
	442,495.86
June 30, 1908, amount expended during fiscal year for works of improvement	85,663.32
July 1, 1908, balance unexpended	356,832.54
July 1, 1908, outstanding liabilities	955.67
July 1, 1908, balance available	355,876.87
July 1, 1908, amount covered by uncompleted contracts	308,619.00
Amount (estimated) required for completion of existing project	364,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	364,000.00

DAM NO. 11.

July 1, 1907, balance unexpended	$424,208.55
Amount appropriated by sundry civil act approved May 27, 1908	200,000.00
	624,208.55
June 30, 1908, amount expended during fiscal year for works of improvement	112,852.30
July 1, 1908, balance unexpended	511,356.25
July 1, 1908, outstanding liabilities	908.71
July 1, 1908, balance available	510,447.54
July 1, 1908, amount covered by uncompleted contracts	436,448.97
Amount (estimated) required for completion of existing project	300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	300,000.00

DAM NO. 13.

July 1, 1907, balance unexpended	$423,656.55
Amount appropriated by sundry civil act approved May 27, 1908	60,000.00
	483,656.55
June 30, 1908, amount expended during fiscal year for works of improvement	169,605.99
July 1, 1908, balance unexpended	314,050.56
July 1, 1908, outstanding liabilities	837.83
July 1, 1908, balance available	313,212.73
July 1, 1908, amount covered by uncompleted contracts	253,486.51
Amount (estimated) required for completion of existing project	240,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 240,000.00

[a] Of this amount, $40,000 is under contract authorization of 1899 and $200,000 under that of 1907.

DAM NO. 18.

July 1, 1907, balance unexpended	$366,669.98
Refunded on account of overpayment	2.00
	366,671.98
June 30, 1908, amount expended during fiscal year for works of improvement	73,023.65
July 1, 1908, balance unexpended	293,648.33
July 1, 1908, outstanding liabilities	14,266.24
July 1, 1908, balance available	279,382.09
July 1, 1908, amount covered by uncompleted contracts	140,650.47
Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	100,000.00

DAM NO. 19.

July 1, 1907, balance unexpended	$207,988.36
June 30, 1908, amount expended during fiscal year for works of improvement	1,859.68
July 1, 1908, balance unexpended	206,128.68
July 1, 1908, outstanding liabilities	458.08
July 1, 1908, balance available	205,670.60
Amount (estimated) required for completion of existing project	725,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	300,000.00

DAM NO. 26.

July 1, 1907, balance unexpended	$234,957.65
Amount appropriated by sundry civil act approved May 27, 1908	110,000.00
	344,957.65
June 30, 1908, amount expended during fiscal year for works of improvement	18,931.72
July 1, 1908, balance unexpended	326,025.93
July 1, 1908, outstanding liabilities	5,752.72
July 1, 1908, balance available	320,273.21
Amount (estimated) required for completion of existing project	855,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	300,000.00

CONSOLIDATED.

July 1, 1907, balance unexpended	$1,963,976.95
Amount appropriated by sundry civil act approved May 27, 1908	506,000.00
Refundment on account of overpayment	2.00
	2,469,978.95
June 30, 1908, amount expended during fiscal year for works of improvement	461,936.66
July 1, 1908, balance unexpended	2,008,042.29
July 1, 1908, outstanding liabilities	23,179.25
July 1, 1908, balance available	1,984,863.04
July 1, 1908, amount covered by uncompleted contracts	1,139,204.95
Amount (estimated) required for completion of existing project	2,584,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	1,604,000.00

(See Appendix G G 1.)

2. Little Kanawha River, West Virginia.—A description of the original condition of the river and its availability for purposes of commerce are given in the Annual Report of the Chief of Engineers for 1875, page 740.

The original project provided for removing rocks, snags, and overhanging and fallen trees above Burning Springs, W. Va., at a cost of $7,300, as adopted by Congress on August 14, 1876. The act of Congress of June 14, 1880, made provision for the construction of a lock and dam about 2 miles above Burning Springs. This lock was opened to navigation on December 2, 1891, and has since been maintained under the indefinite appropriation for operating and care of canals and other works of navigation. Funds are appropriated from time to time for maintaining the present channel by the removal of obstructions which have re-formed.

Congress, in the act of March 3, 1905, provided $75,000 for the purchase and $88,000 for the repair of Locks and Dams Nos. 1–4, owned by the Little Kanawha Navigation Company, the project for which is contained in House Document No. 309, Fifty-eighth Congress, second session, as given in the Annual Report of the Chief of Engineers for 1904, page 2607.

Of the $81,000 made available by act of March 2, 1907, $79,500 is to be applied to the improvement of the structures purchased from the Little Kanawha Navigation Company, as set forth in detail on page 534 of the Annual Report of the Chief of Engineers for 1906; $1,000 for maintenance of improvement above Burning Springs, and $500 for making a preliminary survey for a lock and dam above Lock No. 5.

The amount expended to June 30, 1908, is $384,706.06, of which $1,913.10 was applied to maintenance, $75,000 to acquisition, $93,810.62 to repair of Locks and Dams Nos. 1–4, and $500 to survey above Lock No. 5 ($186.10 was received from sale of unserviceable property).

Slack-water navigation extends from Parkersburg to Creston, W. Va., a distance of 48 miles, and provides a depth of 4 feet. Owing to

the poor condition of the structures purchased from the Little Kanawha Navigation Company, this depth has not been maintained during the low-water season, as the repairs provided for have not been completed.

The maximum draft which can be carried at mean low water over the shoalest place in that section of the river under maintenance of improvement is 6 inches. Flatboat navigation extends to Burnsville, W. Va., about 120 miles above Parkersburg.

Between Creston and Burnsville the high-water mark ranges from 28 feet at Creston to 24 feet at Burnsville. During very dry seasons there are only a few inches of water on the shoals.

As the river did not reach a stage low enough to permit the economical removal of obstructions, no work was undertaken. Work done under War Department permits was inspected.

Extensive repairs were made to Lock and Dam No. 2, and repairs to Lock and Dam No. 1 begun. Guide cribs were built at Lock No. 2, and the lower crib built at No. 1. Obstructions were removed from pool No. 2.

A statement of the commerce is contained in the report for operating and care of locks and dams on Little Kanawha River, West Virginia.

Until the extensive repairs contemplated to the old locks and dams are completed, river navigation will not have a decided effect on freight rates by rail. The rates by river were reduced in an amount equal to the tolls charged by the navigation company since the Government assumed control of Locks Nos. 1–4.

Gasoline boats which formerly plied above Lock No. 5 are now running to Parkersburg. Some new gasoline boats have been built.

Reports on an examination of the river between Lock No. 5 and Burnsville and on the locks and dams "not owned by the Government" are contained in the Annual Report of the Chief of Engineers for 1904, pages 2597 to 2617. Reference to report on survey made in compliance with act of March 2, 1907, will be found on page 602 of this report.

ABOVE LOCK NO. 5.

July 1, 1907, balance unexpended	$1,277.86
June 30, 1908, amount expended during fiscal year for maintenance of improvement	69.20
July 1, 1908, balance unexpended	1,208.66
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	500.00

PURCHASE AND REPAIR OF LOCKS NOS. 1–4.

July 1, 1907, balance unexpended	$42,297.38
June, 30, 1908, amount expended during fiscal year for works of improvement	34,346.28
July 1, 1908, balance unexpended	7,951.10
July 1, 1908, outstanding liabilities	1,321.34
July 1, 1908, balance available	6,629.76
July 1, 1908, amount covered by uncompleted contracts	375.91

BETTERMENTS, LOCKS NOS. 1–4.

July 1, 1907, balance unexpended		$78,363.73
June 30, 1908, amount expended during fiscal year for works of improvement		12,625.45
July 1, 1908, balance unexpended		65,738.28
July 1, 1908, outstanding liabilities		716.46
July 1, 1908, balance available		65,021.82
July 1, 1908, amount covered by uncompleted contracts		1,232.55

SURVEY.

July 1, 1907, balance unexpended	$500.00
June 30, 1908, amount expended during fiscal year	500.00

CONSOLIDATED.

July 1, 1907, balance unexpended		$122,438.97
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$47,471.73	
For maintenance of improvement	69.20	
		47,540.93
July 1, 1908, balance unexpended		74,898.04
July 1, 1908, outstanding liabilities		2,037.80
July 1, 1908, balance available		72,860.24
July 1, 1908, amount covered by uncompleted contracts		1,608.46
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		500.00

(See Appendix G G 2.)

3. Operating and care of locks and dams on Little Kanawha River, West Virginia.—The lock and dam known as No. 5 was built under the appropriation for improving the Little Kanawha River, West Virginia, being a part of the original project as given in the Annual Report of the Chief of Engineers for 1875, page 740.

Locks and Dams Nos. 1–4 were purchased from the Little Kanawha Navigation Company and transferred to the Government on November 1, 1905.

The total amount expended in operating and care of these works to June 30, 1908, is $62,297.96, of which $11,442.43 was expended during the past fiscal year.

A table of the important features, giving location, year when finished, etc., of the locks and dams, is contained in the Annual Report of the Chief of Engineers for 1903, page 1720.

On account of repairs to Locks and Dams Nos. 1 and 2, navigation was suspended at No. 1 for sixty-one days and at No. 2, one hundred and four days. Navigation was suspended about thirty days on account of high water and ice.

The repairs to Locks Nos. 1–3 are provided for under improving Little Kanawha River, West Virginia. The repairs to No. 4 having been completed, its operation and care is a charge under the indefinite appropriation. Extensive repairs were made to the dam and guide cribs at Lock No. 5.

With the exception of the dam and the guide cribs at No. 5, Locks and Dams Nos. 4 and 5 are in good condition. The dam and guide cribs at No. 5 are in poor condition and should be rebuilt; however it is not thought that the rebuilding will be necessary during the coming fiscal year.

During the calendar year 1907 the commerce that passed Lock No. 5 amounted to 99,074 tons, of which 90,321 tons consisted of timber products (saw logs, ties, etc.).

(See Appendix G G 3.)

4. Kanawha River, West Virginia.—A description of the condition of the river, the projects, and the general work accomplished (the locks and dams being in operation) are contained in the Annual Report of the Chief of Engineers for 1900, page 490.

The amount expended under the original project is $50,000; that expended under the present project to June 30, 1908, is $4,178,169.91 ($2,890.75 was received from sales, etc.).

With the exception of steam-power operating machinery for locks, the betterments originally proposed have been completed. There being additional work required, the balance available will be applied to that purpose. During the year the guide cribs for Lock No. 11 were completed, and machinery for operating gates, etc., with steam power installed at Lock No. 8.

The maximum draft that can be carried at the shoalest part of the slack-water system at mean low water is 6 feet. Loup Creek shoal, about 90 miles above Point Pleasant, W. Va., is the head of navigation. The highest stage reached during the year was 31 feet at Charleston; the lowest, 0.8 foot at the falls.

For commercial statistics, see report for operating and care of locks and dams on Kanawha River, West Virginia.

The improvement of this river having been gradual, it is difficult to give the exact effect the improvement has had upon freight rates. There is no doubt, however, that the freight rates, where transportation by water is available, are regulated thereby. The rates for transportation by water have however been increased, due in part at least, to the greater cost of floating plant.

A report of the examination of the unimproved section of the river, about 4½ miles between Lock No. 2 and the falls, is contained in the Annual Report of the Chief of Engineers for 1904, page 2587.

July 1, 1907, balance unexpended	$50,290.20
Amount received from sale	633.43
	50,923.63
June 30, 1908, amount expended during fiscal year for works of improvement	4,339.65
July 1, 1908, balance unexpended	46,583.08
July 1, 1908, amount covered by uncompleted contracts	3,427.44

(See Appendix G G 4.)

5. Operating and care of locks and dams on Kanawha River, West Virginia.—Under the projects for improving the Kanawha River, ten locks and dams were built, two fixed dams and eight movable (Chanoine type), extending slack-water navigation for a distance of 90 miles from the Ohio River. The maintenance of these works is

provided for by the indefinite appropriation for operating and care of canals and other works of navigation.

The location of each lock and dam and year in which completed are given in the Annual Report of the Chief of Engineers for 1899, page 428.

A table of important features, giving available length and width of locks, length of pass, etc., is contained in the Annual Report of the Chief of Engineers for 1903, page 1724.

The total amount expended in operating and care of these works to June 30, 1908, is $874,783.62, of which $96,823.60 was expended during the past year.

Navigation was suspended about seventeen days—six days by ice and eleven days by high water. A stage of 31 feet was reached at Charleston on April 2. The movable dams were operated without accident.

The repairs required to keep the structures in good condition were made. These repairs are becoming more extensive each year, as part of the structures have been in service since 1880. To accommodate the increased force at the movable dams, a new lock house has been built at each of Locks Nos. 4–11.

The commerce for the calendar year 1907 amounted to 1,799,013 tons, with a valuation of $8,574,824. Of the foregoing there were 1,667,000 tons of coal and 69,563 tons of timber products, valued at $1,700,340 and $322,589, respectively.

(See Appendix G G 5.)

SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Report dated January 31, 1908, of survey of *Little Kanawha River, West Virginia, for a lock and dam above the location of existing Lock Numbered Five*, required by the river and harbor act of March 2, 1907, was submitted by the district officer and was reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law. The report was transmitted to Congress and printed in House Document No. 917, Sixtieth Congress, first session. Improvement of the locality as proposed is not considered worthy of being undertaken by the General Government at this time.

IMPROVEMENT OF RIVERS AND HARBORS IN THE SECOND CINCINNATI, OHIO, DISTRICT.

This district was in the charge of Lieut. Col. J. G. Warren, Corps of Engineers, having under his immediate orders Capt. Paul S. Bond, Corps of Engineers, to July 28, 1907, and First Lieut. Arthur Williams, Corps of Engineers, to August 24, and since September 2, 1907. Division engineer, Col. G. J. Lydecker, Corps of Engineers, to November 15, 1907, Col. Charles E. L. B. Davis, Corps of Engineers, from November 15, 1907, to February 15, 1908, and Col. William T. Rossell, Corps of Engineers, since February 15, 1908.

1. Muskingum River, Ohio.—The original condition of the waterway and its availability for purposes of commerce are given in the Annual Report of the Chief of Engineers for 1900, Part 1, page 488. For more extended information reference is also made to the Annual Report of the Chief of Engineers for 1904, Part 1, page 477.

The original project, adopted August 11, 1888, provided for the construction of a lock at Dam No. 9, Taylorsville, Ohio, and the reconstruction of Lock No. 10, Zanesville Ohio. The repair and extension of the levee above Dam No. 10, Zanesville, Ohio, was added by the act of July 1, 1898. Raising the crest of Dam No. 9 and building four lockhouses was added by the act of June 13, 1902.

With the exception of the reconstruction of a lock at Zanesville—which was indefinitely postponed and the money originally appropriated for it diverted to other purposes—all of this work has been completed. The amount expended prior to operations under existing project is $117,339.45.

The existing project, adopted March 3, 1905, provides for the raising of the crest of Dam No. 3, building a lockmaster's dwelling at Lock No. 10, and rebuilding Lock and Dam No. 11.

The amount expended under existing project up to the close of the fiscal year ending June 30, 1908, is $31,394.24.

Raising crest of Dam No. 3 and the construction of lockmaster's dwelling and storehouse, combined, at Lock No. 10 have been completed.

The work under contract with E. J. Landor, of Canton, Ohio, dated April 4, 1907, for constructing Lock and Dam No. 11 and its accessories, was in progress throughout the year. The permanent buildings have been completed; the cofferdam inclosure of lockpit was completed early in the year; about one-half of the shoring required for river bank placed; about 50 per cent of the excavation in lockpit has been finished; and about 60 per cent of the round piling for lock foundation driven. The upper wing wall of the lock has been completed.

The miter-sill depth at pool level is the controlling mean low-water depth of the system. This is now 6 feet at all the locks, except the lower sill at Lock No. 1, at mouth of river, where it is about 3 feet at ordinary low water in the Ohio River.

The head of slack-water navigation is 84 miles above the mouth of the river. The usual variation in the level of water surface is 38 feet at Lock No. 1 and 24 feet at Lock No. 10.

The commercial statistics are reported under the head of operating and care of locks and dams on Muskingum River.

It is believed that this improvement has had no material effect on freight rates.

July 1, 1907, balance unexpended	$160,179.47
Received from sale of public property	303.61
	160,483.08
June 30, 1908, amount expended during fiscal year, for works of improvement	24,354.54
July 1, 1908, balance unexpended	136,128.54
July 1, 1908, outstanding liabilities	270.50
July 1, 1908, balance available	135,858.04
July 1, 1908, amount covered by uncompleted contracts	119,108.31

(See Appendix H H 1.)

2. Operating and care of locks and dams on Muskingum River, Ohio.—The original condition and scope of this improvement is de-

scribed in the Annual Report of the Chief of Engineers for 1901, Part 1, pages 485 and 486. For more extended information reference is also made to the Annual Report of the Chief of Engineers for 1904, Part 1, page 478.

Under allotments from the indefinite appropriation for operating and care of canals and other works of navigation there had been expended up to June 30, 1908, a total sum of $1,785,791.90 and an additional sum of $17,190.44 in building a protection wall at Zanesville and altering certain bridges at Taylorsville and Marietta. The amount expended during the year ending June 30, 1908, was $82,696.68.

The principal work has been dredging bars and channels; making repairs to locks and dams and their appurtenances, lock houses and grounds, and floating plant; constructed a concrete revetment 100 feet in length on bank of river; refilled and graded eroded bank at left end of dam at Lock No. 3; reconstructed in concrete the conduit leading from the canal above lock to the mill race below; reconstructed in concrete the guide and guard cribs below the lock, and reconstructed in concrete the storehouse and waiting room at Lock No. 4; reconstructed in concrete a washout of the embankment 14 feet in length running from head of lock to high ground; refilled with earth a washout in the terreplein of lock below embankment, and replaced in concrete 18 cubic feet of masonry damaged by ice and drift in head of river wall of lock at Lock No. 5; reconstructed in concrete two guard cribs above lock and the guide crib below the land wall of lock at Lock No. 6; replaced table of planer in workshop; repaired the flood-damaged doors and windows; built an extension to the planer, and repaired the turbine and machinery in the shop at Lock No. 7; replaced with concrete 20 feet in length of the stone coping of a retaining wall above the right abutment of dam; renewed 12 guard piles above the river wall of lock; extended the wooden guide crib below the river wall of lock 25 feet at Lock No. 8; reconstructed in concrete 215 feet in length of revetment of canal embankment and 43 feet in length of the guard crib below lock at Lock No. 9; reconstructed in concrete 24 feet in length of the guide and guard cribs above lock and 90 feet in length of the guide crib below land wall of lock; reconstructed in concrete approximately 257 feet in length of the revetment of the canal embankment above the land wall of lock at Lock No. 10, and the establishment of tentative harbor lines at Zanesville, Ohio; constructed a new towboat, named the U. S. S. *Merrill.*

Navigation was closed on account of ice in the channels from January 28 to February 9, a period of thirteen days, and on account of high water in February and March for a period of seventeen days.

The total commerce for the year 1907 was approximately 78,600 tons, valued at $2,470.000, and 60,000 passengers.

(See Appendix H H 2.)

3. Big Sandy River and Levisa and Tug forks, West Virginia and Kentucky.—For more extended information concerning the early history of this improvement, reference is made to the following annual reports of the Chief of Engineers: For the year 1875, pages 756–769; for the year 1904, Part 1, page 479, and for the year 1905, Part 1, pages 488–489.

In their original condition this river and its forks were much obstructed by rocks, bars, snags, and leaning trees. During the low-water period of each year navigation was practically suspended.

The original project was adopted July 18, 1878, and provided for the removal of rocks, snags, and overhanging trees from the Big Sandy River and its forks. The construction of a lock and fixed dam below the junction of the two forks and near Louisa, Ky., was added by the act of June 14, 1880, and in 1891 was modified to admit of the construction of a movable instead of a fixed dam.

The work of clearing the forks of obstructions is carried on from year to year as funds are made available.

The amount expended on original and modified projects prior to operations under existing project, exclusive of maintenance on Levisa and Tug forks, was $380,590.66.

The existing project, adopted March 3, 1899, contemplates carrying slack water from the Ohio River to Pikeville on Levisa Fork and to the mouth of Pond Creek on Tug Fork by the construction of 21 locks and dams, at an estimated cost of $4,725,000. Of these locks and dams 10 are proposed for the Levisa Fork, 8 for Tug Fork, and 3 for the main river. The survey made for this improvement developed the fact that only 2 locks and dams would be required for the main river.

The raising of the crest of Dam No. 3, at Louisa, Ky., was added by the act of June 13, 1902, at an estimated cost of $35,000.

The improvement at the mouth of the Big Sandy River by the construction of regulating works was added by the act of March 3, 1905, at a cost of $40,000.

The construction of a steel service bridge at Lock No. 1, Big Sandy River, was added by the act of March 2, 1907, at a cost of $7,000.

The amount expended on the work of the existing project up to the close of the fiscal year ending June 30, 1908, was as follows:

Big Sandy River, general improvement, including maintenance	$783,405.80
Levisa Fork, maintenance	31,947.14
Tug Fork, maintenance	31,284.06

and at that date Lock and Dam No. 1, at Catlettsburg, and No. 2, at Kavanaugh, Ky., Big Sandy River, had been completed (Lock and Dam No. 3, at Louisa, Ky., were completed in 1897); the regulating works at its mouth under construction, but little accomplished; specifications issued inviting proposals for the construction of a steel service bridge at Lock No. 1—all bids received were rejected, the lowest one being far in excess of the amount appropriated for this work; a contract for raising the crest of Lock and Dam No. 3 and the construction of steel lock gates was entered into; the contractor began preliminary work early in February, delivered material, installed plant, opened quarries, erected temporary buildings, constructed cofferdam inclosing the abutment, weir, and pier; completed excavation for the extension of abutment and pier, and service-bridge apron for weir; and all round and sheet piling driven. The iron and stone sills of the old weir were removed, all hurters placed, channels for tripping bar and wicket cushion cut, and the greater part of the cutting of old masonry for machinery recesses and junction of concrete was done, and at the close of the year the work was in a satisfactory state of advancement. Lock No. 1, Levisa Fork, and Lock No. 1, Tug Fork, were completed, and specifications were issued inviting proposals for

the construction of the dams for these locks; proposals were opened on June 26 and July 2, 1908, respectively.

With the exception of the service bridge at Lock No. 1, raising crest of Dam No. 3, and the regulating works at its mouth, which are provided for by specific appropriations to make the improvement available, the work is being carried on under the continuing-contract system, and the balance of the authorization remaining to be appropriated is $50,000. This amount, in addition to the unexpended balance on June 30, 1908, can be profitably expended in the fiscal year ending June 30, 1910, in the extension of benefits by the construction of Dam No. 1, Tug Fork, and Dam No. 1, Levisa Fork.

For the purpose of providing sufficient funds for the construction of Dam No. 1, Tug Fork, and Dam No. 1, Levisa Fork, with a view to completing the whole work as originally contemplated, it is recommended that an additional appropriation of $25,000 be made prior to the date set for completion of the work now recommended for award. Congress has appropriated and authorized the expenditure of $235,000 for this work, and the additional appropriation herein recommended is therefore in the nature of an extension of the present limit of authority.

The river and harbor act of March 2, 1907, appropriated $7,000 for the construction of a steel service bridge at Lock No. 1, Big Sandy River. Specifications were issued inviting proposals for this work, and the lowest bid received was $8,738.90. All bids were rejected as excessive, and preparations were made for the construction of the bridge by hired labor and the purchase of materials. After circulars were prepared inviting proposals for purchase of materials for the construction of the bridge, a condition occurred at this lock which, so far as the records show, had not obtained before. A sharp rise occurred in the Big Sandy River with the Ohio River at a low stage and, as a result, the sand along the upper face of the existing weir foundation was scoured for a distance of over 65 feet back from the pier toward the abutment. This, of course, rendered it unsafe to make use of a pile foundation at the pier end of the service bridge as originally planned. Plans for the construction of the bridge at Lock No. 1 have been prepared, using cribs at the pier end instead of piles, and it appears under existing prices for labor and material that it will not be practicable to construct the bridge with the amount appropriated. An additional appropriation of $3,000 is therefore recommended.

Three locks and dams on the Big Sandy River have been completed and opened to navigation. They provide a minimum depth of 6 feet on their lower miter sills, except at Lock No. 1, Catlettsburg, Ky., where the depth on the lower miter sill depends upon the stage in the Ohio River, and is uncertain and will remain so until a dam is placed in the Ohio River immediately below Catlettsburg.

The minimum draft that can be carried over the shoalest portions of the forks at mean low water is uncertain and changeable, and can not be definitely stated owing to the constant movement of the bottom and the fact that the obstructions naturally renew themselves.

The commerce consists largely of timber, cross-ties, and staves, and varies somewhat with the condition of the streams, being greater during wet seasons and least during a long continued dry term. In

general, it is about 125,000 tons for Tug Fork and 175,000 tons for Levisa Fork, a total of 300,000 tons per annum.

The Big Sandy River is navigable by steamer from Catlettsburg, the mouth of the river, up to Louisa, Ky., a distance of 27 miles, and upon the completion of the work of raising the crest of Lock and Dam No. 3 it will be navigable from there to Chapman, Ky., on Levisa Fork, and Saltpetre, W. Va., on Tug Fork, a distance of 9 and 4 miles, respectively. For pole boats, rafts, etc., the head of present navigation is taken at Pond Creek on Tug Fork and at Pikeville on Levisa Fork.

It is believed that the work thus far accomplished on this improvement has had no material effect on freight rates.

Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 612 of this report.

It is deemed advisable that provision should be made for the necessary surveys to locate sites and for acquisition of land required for additional locks and dams to be constructed under the adopted project in order to avoid delays incident to such work after appropriations for actual construction have been made.

For reasons stated in the appendix to this report, the district officer considers a small dredging plant necessary for the operation and maintenance of this improvement, and estimates the cost of the same at $17,500.

A detailed statement of commercial statistics will be found in report for operating and care, etc.

July 1, 1907, balance unexpended	$207,751.13
Received from various sources	105.29
Amount appropriated by sundry civil act approved May 27, 1908	85,000.00
	292,856.42
June 30, 1908, amount expended during fiscal year for works of improvement	21,273.16
July 1, 1908, balance unexpended	271,583.26
July 1, 1908, outstanding liabilities	1,225.00
July 1, 1908, balance available	270,358.26
July 1, 1908, amount covered by uncompleted contracts	40,898.71
Amount (estimated) required for completion of existing project	3,755,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	*78,000.00

(See Appendix H H 3.)

4. Operating and care of locks and dams on the Big Sandy River, West Virginia and Kentucky.—For more extended information reference is made to the following Annual Reports of the Chief of Engineers: For the year 1904, Part 1, page 481, and for the year 1905, Part 1, page 490.

* Of this amount $50,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907; $25,000 for completing improvement at Dam No. 1, Levisa Fork, and Dam No. 1, Tug Fork, and $3,000 for completing steel service bridge at Lock No. 1, Big Sandy River.

Under allotments from the indefinite appropriation for operating and care of canals and other works of navigation there had been expended up to June 30, 1908, a total sum of $81,737.43. The amount expended during the year ending June 30, 1908, was $22,734.53.

The principal work has been clearing the channels and lock approaches of snags and other obstructions; making repairs to locks, lock gates, operating machinery, dams, lock houses, and floating plant; repairing butterfly valves in upper lock gates, construction of protection works below abutment of dam; repairing and remodeling old workshop for use as a storehouse and blacksmith shop; construction of a light push boat at Lock No. 1; sodding slope back of land wall of lock; repairs to cylindrical valve and upper lock gates; constructing concrete walk, and coal and oil house combined, at Lock No. 2; construction of workshop and tool house combined, and maneuvering boat for dam; constructing a storehouse on Kentucky side of river, new steel lock gates, bank protection below abutment, and purchase of new set of needles for dam at Lock No. 3.

Lock No. 1 was out of commission during the entire year on account of construction of regulating works below the lock. Navigation at this lock was suspended between February 20 and October 6 on account of the pass being closed by reason of the construction of protection works below abutment of dam.

Lock No. 2 was open to navigation throughout the year.

Navigation at Lock No. 3 was suspended during the entire year on account of the work of raising the crest of the lock and dam, constructing new steel gates for the lock, and protecting the bank below abutment.

The total commerce for the year 1907 was approximately 194,634 tons, valued at $1,685,860, and 619 passengers.

(See Appendix H H 4.)

5. *Kentucky River, Kentucky.*—For more extended information reference is made to the Annual Report of the Chief of Engineers for the year 1906, Part 1, pages 541 and 542. At the time the United States assumed control of the Kentucky River the improvement that had been made by the State of Kentucky, which included five locks and fixed dams, was found to be in a dilapidated and almost worthless condition. Portions of Dams Nos. 1 and 2 on the lower part of the stream were gone entirely, so that navigation was suspended.

The original and existing project was adopted in 1879 (Annual Report of the Chief of Engineers for 1879, pp. 1398–1422), and provides for repairing and rebuilding the five old locks and dams, removing snags, logs, and other obstructions, and extending 6-foot slack-water navigation from the mouth of the river to the Three Forks, a distance of about 261 miles.

The amount expended to June 30, 1908, was $2,927,439.84.

The result of this expenditure was the repair and the rebuilding of five old locks and dams constructed by the State; the construction of Locks and Dams Nos. 6, 7, 8, 9, 10, and 11; the purchase of sites for these and for Locks and Dams Nos. 12, 13, and 14, and the partial construction of Lock and Dam No. 12; preparation of plans and specifications for constructing Lock and Dam No. 13; construction of dam at Beattyville, Ky., and survey to determine the amount of damage by flowage to private property by reason of the construction of Locks and Dams Nos. 9, 10, and 11.

This work is being carried on under the continuing-contract system, and the balance of the authorization remaining to be appropriated is $210,000. This amount, together with the unexpended balance on June 30, 1908, can be profitably expended in the fiscal year ending June 30, 1910, in the extension of benefits by the construction of Locks and Dams Nos. 12 and 13.

The estimated cost of Lock and Dam No. 14 is $415,650, not provided for in any existing legislation.

The amount of the contract for construction of Lock and Dam No. 12, including engineering and contingent expenses, is $419,439.62.

The actual amount required to complete the existing project as it now stands is estimated at $865,650, to be expended as follows:

Amount required to build Lock and Dam No. 13, with appurtenances, is estimated at $500,000, $50,000 of which is now appropriated, leaving a balance yet to be appropriated ($210,000 of which is authorized) of	$450,000
Amount required to build Lock and Dam No. 14, with appurtenances, is estimated at	415,650
Total	865,650

The total amount of the present authorization will become exhausted with the completion of Lock and Dam No. 12, with the exception of a possible balance of $260,000. In addition thereto an additional appropriation of $240,000 will be necessary for the construction and completion of Lock and Dam No. 13.

It is thought that the estimated cost of these locks and dams contained in the present approved project ($415,650 each) is sufficient in the aggregate for their completion, but it is quite likely that, owing to local conditions, the individual cost will vary materially, as, for instance, the reason for the increase in cost of Lock and Dam No. 13 over that of No. 12 is due to the depth of the rock foundation, which will require quite an additional amount of excavation, concrete, and embankment.

The construction of Locks and Dams Nos. 9 and 10 has also caused damages to the highways of Madison County by back water in Tates Creek and Otter Creek. Tates Creek enters the Kentucky River about one-half mile above Lock 9. There is a county road crossing this creek a few hundred feet above the mouth, which is the principal outlet for a large number of residents dwelling on the left-hand side going up this creek. Since the construction of No. 9 this crossing has been rendered useless. In order to restore the crossing, a bridge will have to be constructed. From estimates already obtained it is thought that a suitable bridge can be built for approximately $3,500, and an appropriation of this amount is therefore recommended. Otter Creek is situated one-half mile below Ford, Ky., and one-half mile above Dam No. 10. Since the construction of this dam the county road running along this creek has been rendered impassable. This road meets the Richmond and Boonesboro (Ky.) turnpike and is the principal outlet for a large number of families scattered along this creek. For the purpose of restoring this road to public traffic an appropriation of $2,500 is recommended. This work constitutes an item of contingent expense that was not foreseen when the estimate of cost of constructing these locks and dams was prepared, and an appropriation of $6,000 to cover the cost of the additional work indi-

cated is a proper charge to this improvement and should be provided in addition to sums heretofore authorized.

The greatest draft which can be carried at mean low water from Lock No. 1 to a point 2 miles above Irvine, Ky., a distance of 226 miles, which is at present the head of slack-water navigation, is 5.5 feet. Above this point no boats can run at a low stage.

Ordinary low-water depth through Lock No. 1 and to the Ohio River, 4 miles below, is 6 feet or more, but at extreme low water only about 2½ feet can be carried over the lower sill of Lock No. 1. The usual variations of level of water surface are from 23 to 40 feet and occasionally much more.

The old locks, Nos. 1 to 5, inclusive, built by the State, have 145 feet available length and 38 feet width. The new locks, from No. 6 up, have available lengths of from 146 to 148 feet and are 52 feet in width.

The principal commerce of the river is timber, much of it loose logs, and the improvement is rather detrimental to this than otherwise. The logs are damaged in passing the dams and in their turn cause much damage to the works—are a prolific source of snags and of discouragement to any steamboat traffic that might develop.

Commercial statistics in detail are given in the report for operating and care of locks and dams on Kentucky River.

The unexpended balance and appropriation recommended will be applied to construction of Locks and Dams Nos. 12 and 13 for extension of benefits.

There are not likely to be any decided changes in the volume or character of the commerce benefited until the improvement is carried to the head of the river, where it is hoped that coal lands may be developed and the product shipped by river. The development of coal lands, with the resulting traffic, is the specific purpose to which the expenditure will be applied. It is believed that the project has so far had no material effect on freight rates.

July 1, 1907, balance unexpended	$259,883.36
Received from other sources	128.00
Amount appropriated by sundry civil act approved May 27, 1908	309,000.00
	569,011.36
June 30, 1908, amount expended during fiscal year, for works of improvement	24,129.92
July 1, 1908, balance unexpended	544,881.44
July 1, 1908, outstanding liabilities	472.06
July 1, 1908, balance available	544,409.38
July 1, 1908, amount covered by uncompleted contracts	378,409.94
Amount (estimated) required for completion of existing project	865,650.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	[a]450,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix H H 5.)

[a] Of this amount $210,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907, and $240,000 for the completion of Lock and Dam No. 13.

6. Operating and care of locks and dams on Kentucky River, Kentucky.—At the time the United States acquired possession of the five locks and dams on this stream, in 1880, navigation, then extending for a distance of 87 miles upstream, was practically suspended on account of deterioration of the works. These five locks and dams were built by the State of Kentucky in 1836–1839, and from 1880 to 1885 were extensively repaired by the United States under appropriations for improving Kentucky River, Kentucky. Since then extensive repairs have been made under the indefinite appropriation of 1884 for operating and care of canals, etc.; and Locks and Dams Nos. 6, 7, 8, 9, 10, and 11 have been constructed. Additional information will be found in the Annual Reports of the Chief of Engineers for 1906, Part 1, page 543, and for 1907, Part 1, pages 568–569.

Under allotments from the indefinite appropriation for operating and care of canals and other works of navigation there has been expended up to June 30, 1908, a total sum of $1,636.206. 19. The amount expended during the year ending June 30, 1908, was $119,223.79.

The principal work has been dredging bars and channels; making repairs to locks, lock gates, operating machinery, dams, lock houses, and floating plant; replacing sheeting and range timber, and in constructing concrete face on 200 feet of the downstream side of dam, at Lock No. 3; replaced worn-out and torn-off sheeting of dam at Lock No. 4; renewal of torn-off decking of dam, reconstructing upper lock gates in steel, reconstructing in concrete upper miter sill of lock, at Lock No. 5; repairs to lower wall valve of lock at Lock No. 6; reconstructing in concrete the sloping face of timber-step dam at Lock No. 8; constructing protection works below Lock No. 9; completing repairs to washout caused by flood of 1905, constructing protection works below abutment and raising abutment end of dam, reenforced with concrete the concrete wall at lock end of new dam, raised lower guide wall to level of lock wall, constructed concrete walk on top of bank and from river to foot of hill and from lockman's house over lock grounds, widened, with concrete, the land wall of lock sufficiently to properly operate the gate racks, and constructed floating boom at upper end of lock to facilitate the entrance of rafts, at Lock No. 10; repaired movable crest of dam at No. 11; entered into contract for the construction and delivery of machinery for a new dredge boat, the hull for which is to be constructed by hired labor and purchase of materials; under contract dated May 24, 1907, two new dump scows were completed, at a cost of $6,216; under contract dated February 27, 1908, two new barges were completed, at a total cost of $4,300.

Navigation was suspended at the various locks, due to high water, repairs, etc., for a total of two hundred and forty days.

The total commerce for the year 1907 was approximately 371,000 tons, valued at $5,844,000, and 13,259 passengers.

(See Appendix H H 6.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were re-

viewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents, as indicated:

1. Preliminary examination of Big Sandy River, with a view to improving its headwaters, including Pound River and Russel Fork, Virginia and Kentucky.—Report dated June 15, 1907, is printed in House Document No. 222, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. Preliminary examination of Guyandot River, West Virginia.—Report dated June 14, 1907, is printed in House Document No. 558, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government further than for maintenance under previous projects.

IMPROVEMENT OF RIVERS AND HARBORS IN THE LOUISVILLE, KENTUCKY, DISTRICT.

This district was in the charge of Capt. Harry Burgess, Corps of Engineers. Division engineer, Col. G. J. Lydecker, Corps of Engineers, to November 15, 1907, Col. Charles E. L. B. Davis, Corps of Engineers, from November 15, 1907, to February 15, 1908, and Col. William T. Rossell, Corps of Engineers, since February 15, 1908.

1. Falls of the Ohio River at Louisville, Ky.—Improvements under this title have included the enlargement of the basin immediately above the locks of the Louisville and Portland Canal, the enlargement of the head of the canal, and straightening, deepening, and controlling the water flow in the Indiana Chute channel.

The work of enlarging the basin above the canal locks was completed in 1893.

The original conditions at the other localities are more conveniently and fully described under separate headings, as follows:

Head of Louisville and Portland Canal.—Previous to 1883 the approach to the canal at its upper end, above the Louisville Bridge Company's bridge at Fourteenth street, was so narrow as to constitute a source of much expensive delay to the large quantity of traffic which came down the river on ordinary rises. The canal proper from Ninth to Fourteenth streets was only 100 feet wide and curved between the two points, so that progress was slow and accidents frequent and unavoidable. The greater part of the dike marking the north side of the approach to the canal was submerged when the river reached a stage of 8.4 feet, upper canal gauge, and at stages of 9 feet or more a strong current set out from the shore, thus carrying many vessels against the dike and, at high enough stages, over it onto the rock ledges. This approach was 1,800 feet long and varied in width from 400 feet at the upper end to 100 feet opposite Ninth street. Its area was wholly insufficient for the required breaking and rearrangement of tows preparatory to entering or leaving the canal.

Indiana Chute.—This is the main channel of the river by which commerce passes over the falls when the stage of water is such as to permit navigation via that route. Originally it was very crooked, with swift currents and whirls, filled with dangerous rocky points projecting from the sides and bottom, and it could be navigated only at stages of 11 feet or more, upper canal gauge. Even at such stages

the services of special skilled pilots of long local experience and having intimate knowledge of the channel conditions were essential for reasonably safe passage through it.

Projects.—The original project for the enlargement of the head of the Louisville and Portland Canal was adopted in 1883 and proposed the enlargement of the canal, beginning at a point a short distance below the railroad bridge at Fourteenth street and extending eastwardly to the cross dam, so as to not only straighten and widen the canal proper, but also provide ample space for the necessary rearrangement of tows about to enter or leave the canal. This was slightly modified in 1885, so far as the location of the new north wall was concerned. A revision of the project was made by a Board of Engineer officers January 28, 1890, and approved by the Chief of Engineers January 31, 1890. This revision modified the area formerly proposed to be excavated and determined the number and kinds of structures, etc., to be erected. As approved, it provided for enlarging the canal on its northerly side from a point 725 feet below the railroad bridge at Fourteenth street, where the width of the canal was abruptly increased from 90 feet to 210 feet. This latter width is then gradually increased through a distance of nearly 2,800 feet to 325 feet at the head of the canal proper, at which point the enlargement is expanded into a capacious basin or harbor 1,200 feet wide and practically parallel to the Kentucky shore. The structures proposed were a new retaining wall on the north side of the canal, a movable dam about 800 feet long, a fixed dam extending from the movable dam at the westerly end of the basin to the south abutment of the movable dam in the Middle Chute opening of the cross dam, the excavation of rock within designated limits to the same grade as the canal bottom, the construction of certain walls and slope revetment on the south side of the canal, and the removal of the old structures within the limits of the proposed enlargement. Under date of March 31, 1899, a further modification of some of the details of the project was considered by a Board of Engineer officers and their recommendations approved by the Chief of Engineers April 8, 1899. These later modifications, together with the work outlined in the report approved January 31, 1890, constitute the existing project toward the completion of which operations are now directed. The totals of estimates under the original project and the several revisions are as follows:

Project of 1883, page 1539, Annual Report of the Chief of Engineers for 1883	$1,335,363.00
Revision approved January 31, 1890, page 2217, Annual Report of the Chief of Engineers for 1890	710,230.40
Modification approved April 8, 1899, page 2545, Annual Report of the Chief of Engineers for 1899	300,391.92
A revision of the latter estimate was made November 13, 1900, approved by the Chief of Engineers November 17, 1900, and amounted to	398,359.12

The foregoing relates particularly to the improvements at the head of the Louisville and Portland Canal.

Prior to January 31, 1890, there was no specific comprehensive project for the systematic improvement of the Indiana Chute channel, although much work, consisting of the removal of some of the more dangerous rock ledges, had been done under estimates and allotments

from appropriations for improving Ohio River. On the date just mentioned the project submitted by a Board of Engineer-officers for the radical improvement of this chute was approved by the Chief of Engineers. This project had for its object the widening and deepening of the channel by rock excavation to specified grades within certain limits and the control of water flow in the channel by means of dikes, etc., so as to make this channel available for descending navigation drawing 6½ feet at stages of 8 feet, upper canal gauge. However, only a part of the work necessary for the purpose in view was included in the estimate accompanying the report of the Board, it being stated:

> As the exact knowledge of the results of that work [i. e., the work estimated for in the Board's report] would be of great importance in fixing the details of location and cross section of the additional works that will be required, it would be as well to leave the determination of the additional work above the bridge to a later day.

The estimates for work on this chute since the adoption of a specific project therefor are as follows:

Project approved January 31, 1890	$138,610.97
Modification approved April 8, 1899	74,320.98
Revision of estimate approved by the Chief of Engineers November 17, 1900	129,651.99

A consolidation of the projects for the enlargement at the head of the canal and the improvement of the Indiana Chute was authorized by the Chief of Engineers June 28, 1897, and since that date funds have been provided for work at both localities under one title of appropriation.

Work under that part of the project relating to the Indiana Chute having been completed, a Board of Engineer officers was assembled to determine, as anticipated in the project of 1890, what further work was essential to provide the requisite depth necessary to facilitate the passage of traffic through this channel. The report of the Board was submitted December 16, 1901, and approved by the Chief of Engineers December 30, 1901. The items of additional work found to be necessary to produce the desired result and the estimated cost thereof are as follows:

Submerged dam at Whirlpool Point (large stone), 2,500 cubic yards, at $3	$7,500
Raising movable dam north of canal wall	2,500
Removing old dam and building movable dam, 1,000 feet, at $75	75,000
Longitudinal contracting dikes (concrete), 22,300 cubic yards, at $12	267,600
Submerged dams below bridge (concrete), 3,000 cubic yards, at $20	60,000
Rock excavation, 3,200 cubic yards, at $3.50	11,200
Contingencies, 10 per cent	42,380
Total	466,180

For this latter work the Board prescribed the order in which it should be done, and stated that it was possible that a part of the work might become unnecessary if certain results were produced by the submerged dam at Whirlpool Point, and in that event about $125,000 would probably be saved from the estimated cost.

The estimate for this additional work on the Indiana Chute does not affect the former estimate for work to be done at the head of the canal, except in so far as it provides $2,500 for increasing the height of the movable dam north of canal wall. This item has been revised

and the reconstruction of that section of dam with a crest elevation of +12.7 feet, upper canal gauge (415.704 feet above sea level), provided for from the appropriation of $271,000 made by act of March 2, 1907, and $240,000 of the said appropriation will be used for the construction of 500 feet of Boulé dam in Middle Chute, 648 feet of Chanoine dam in Indiana Chute, and about 600 linear feet of concrete dam between Indiana Chute and the north bank of the river. These sections of dam constitute additions to the former projects, and are to have their crests at elevation +9 feet, upper canal gauge (412.004 feet above sea level). This height is such as will afford a minimum depth of 9 feet upstream to Madison, Ind., and a minimum depth of 6 feet on the lower miter sill at Lock No. 1, Kentucky River.

Following is a brief synopsis of expenditures under the allotments and projects summarized above:

Expended from allotments, 1881, to January 31, 1890		$116,049.80
Expended under project of 1883, for enlargement of head of canal, to January 31, 1890		347,380.68
Reserved, Office Chief of Engineers, United States Army		1,874.20
Expended under project for enlarging canal basin at locks		133,000.00
Expended under revised project of January 31, 1890, to June 30, 1897:		
On enlargement at head of canal	$298,856.35	
On Indiana Chute channel	103,602.81	
		402,459.16
Expended under appropriations for enlargement at head of canal and Indiana Chute, in accordance with project of January 31, 1890, to March 31, 1899		208,659.75
Expended under appropriations for enlargement at head of canal and Indiana Chute, in accordance with the modified project of March 31, 1899 (approved April 8, 1899), to June 30, 1908, not including outstanding liabilities		561,403.05
Total		1,770,826.64

Expenditures during the fiscal year were for work as follows:	
Boulé dam, section No. 1	1,181.67
Boulé dam, sections 2 and 3	9,632.97
Boulé dam, section No. 5	16,365.19
Boulé dam, sections 6, 7, 8, and 9	52,147.66
Chanoine dam, section No. 10	29,477.92
Concrete dam, section No. 11	7,817.33
Removal of rock	20,188.13
Total	136,810.87

The results derived from the expenditures to date for those portions of the work completed have been of marked advantage to traffic and greatly facilitate its movement. The enlargement of the basin immediately above the new locks was completed in 1893 and increased the width of the canal at that locality from 90 feet to 215 feet throughout a distance of 800 feet. At the head of the canal the work of enlargement has been entirely completed from a point 725 feet below the Fourteenth Street Railroad Bridge to a point 2,800 feet above that bridge. Beyond this point, in the basin east of the north canal wall, the excavation to grade within the prescribed limits is about 97 per cent completed, a clear width of 415 feet excavated to grade being at this date available.

In Indiana Chute above Fourteenth Street Bridge the channel width has been increased from 200 feet to 400 feet, and all rock within these limits excavated to the grades prescribed in the project. At

Wave rock and Willow Point all excavation and the dikes have been completed. The depth of water over Wave rock and Willow Point approximates very closely the depth anticipated—i. e., 8 feet, when there are 8 feet on the upper canal gauge. But the depth on the upper portion of the chute is still unsatisfactory; hence the necessity for the additional work recommended in the Board's report of December 16, 1901, and approved by the Chief of Engineers December 30, 1901. The additional work includes structures designed so as to produce the desired depth of 8 feet by forcing a sufficient volume of water into that part of the chute above the Fourteenth Street Bridge and controlling its flow therein. The chute can now be navigated with ease by heavy-draft coal boats at stages of 11.5 or more, upper canal gauge, but as coal barges reach Louisville on an 8-foot stage and coal boats on a 9½-foot stage, the necessity becomes apparent for providing sufficient depth in the open-river channel in order to facilitate the passage of commerce without the heavy unavoidable incidental expense due to breaking, rearranging, and passage of tows through the canal locks, and, not infrequently, the loss of opportunity to continue without interruption the journey on the stage of water prevailing on arrival of the tow at this place, the stage in many instances being of such short duration as to pass before the tows can be passed through the canal, reassembled, and regain the crest of the wave.

The following statement shows the remaining items of approved projects for which no appropriations have been made:

2,500 cubic yards, submerged dam at Whirlpool Point	$7,500.00
22,300 cubic yards, longitudinal contracting dikes	267,600.00
3,000 cubic yards, submerged dams below railroad bridge	60,000.00
3,200 cubic yards, rock excavation, Indiana Chute	11,200.00
Contingencies	34,630.00
Total	380,930.00

In the statement of last year's report the "amount (estimated) required for completion of existing project" was given as $472,215.99, made up as follows:

Balance of estimate approved November 17, 1900		$81,035.99
Balance of cost of work recommended in Board's report of December 16, 1901, approved December 30, 1901		391,180.00
Total		472,215.99
The act of March 2, 1907, added new work, not included in either of the above items, amounting to		271,000.00
Thus making a total of		743,215.99
From which there must be deducted amounts appropriated by the act of March 2, 1907, as follows:		
For raising the dam	$271,000	
For removal of rock	43,000	
		314,000.00
Leaving a balance of		429,215.99

as the "amount (estimated) required for completion of existing project" at the close of the past fiscal year, which amount is more than ample for the remaining items of work under existing projects. But the Ohio River Board has recommended that these remaining items of work be not done, as the work recommended by that Board will render such items of work unnecessary. Therefore it is not deemed advisable to make any modification of present estimates for

completion of project until Congress has indicated which of the plans is to be pursued.

July 1, 1907, balance unexpended	$348,483.09
June 30, 1908, amount expended during fiscal year for works of improvement	136,810.87
July 1, 1908, balance unexpended	211,672.22
July 1, 1908, outstanding liabilities	321.10
July 1, 1908, balance available	211,351.12
Amount (estimated) required for completion of existing project	429,215.99

(See Appendix I I 1.)

2. Operating and care of Louisville and Portland Canal.—This canal was constructed by a private corporation, acting under a charter granted by the Kentucky legislature in 1825, and subsequent acts of the same body extending the time for completion and increasing the capital stock. It was completed and the first boat passed through it December 22, 1830. At that time there were three combined lift locks, each with a lift of about 8⅔ feet, a width of 50 feet, and length of 200 feet. The width of the canal proper was from 64 to 68 feet at normal stages, with a depth of nearly 3 feet at extreme low stages of the river. There was no dam at the head of the canal. The United States became a stockholder in the corporation in 1826, and gradually increased its holdings until all of the outstanding stock and bonds passed into its possession.

In 1860 an enlargement and extension of the canal which included new locks was begun under the corporate management, and resulted in the width of the canal being increased to 90 feet, with three basins, or passing places, and the construction of two new combined lift locks with a total lift of about 26 feet. Each of the chambers of the new locks has a width of 80 feet and an available length of 350 feet. The new locks were opened to navigation February 6, 1872.

The United States assumed charge of the work of enlargement of the canal and construction of a dam at the head of the canal subsequent to the allotment of funds for that purpose in 1868, but the operation of the canal and collection of tolls remained under control of the corporate management until June 11, 1874, upon which date the entire control of the canal was assumed by the United States, pursuant to the act of Congress of May 11, 1874, which provided that the canal should be held "free of all tolls and charges, except such as are necessary to pay the current expenses of said canal and keep the same in repair." Tolls were entirely abolished after midnight, July 1, 1880, and since that date the expenses of operation and maintenance of the canal have been borne directly by Treasury funds made available by the act of March 3, 1881, and the indefinite appropriation for "Operating and care of canals and other works of navigation," act of July 5, 1884.

The general project for operation and care of the canal by expenditures under allotments from the act of July 5, 1884, contemplates the operation of the canal locks, the operation of the dredging plant to keep the canal clear of deposit brought into it by high water, and the repair of existing structures, so as to maintain the whole system in good serviceable condition. The funds are provided under estimates

submitted annually at the beginning of each fiscal year and allotments therefor from the act of July 5, 1884.

The approved project, estimate, and allotment for the fiscal year 1908, in addition to the provisions for ordinary current repairs, supplies, miscellaneous work of maintenance, operation of locks, and dredging plant included items for completing south canal wall, two steel barges, and two dump scows. The estimate for the year amounted to $113,265.58, and was made available July 18, 1907.

In reporting the total of expenditures made in connection with this work it seems best, for the purpose of clearness in showing the general application, to subdivide the total to date into amounts for each period indicated, as follows:

From allotments and appropriations, September, 1868, to June 30, 1882, for completion of new locks, enlargement of canal, and for cross dam at head of canal, payment of bonds, etc	$1,463,200.00
From tolls collected by United States, June 11, 1874, to midnight July 1, 1880, for operation and maintenance	417,069.38
From allotments from act of March 3, 1881, for operation and maintenance	214,062.91
From allotments from act of July 5, 1884, for operation and maintenance	2,043,368.88
Total	4,137,701.17

The amount expended during the past year is $103,114.15.

The canal is available to commerce at all stages of the river less than 12.7 feet, upper canal gauge, and affords free navigation around the falls of the Ohio River at stages of water when the passage thereover can not be made by the open-river channel.

The zero of the upper gauge corresponds to reference 35 and the bottom of the canal at its head to reference 34, canal datum. The lowest recorded reading of the upper gauge is 1.7 feet; the highest reading on the same gauge is 46.7 feet.

Under the regulations prescribed by the Secretary of War for the use, administration, and navigation of this canal the maximum draft of vessels that can be passed through the canal is limited to the depth of water above zero of the gauge at the time the boat enters the canal.

References to more extended information concerning original condition, purchase, and progress of the improvement of this canal are given on page 491, Annual Report of the Chief of Engineers for 1904.

For a comparative statement of commerce, see the report on this work by district officer.

During the fiscal year ending June 30, 1908, 5,069 boats, barges, and small craft passed through the canal, carrying 1,171,240 tons freight. During the same period 1,924 boats, barges, and small craft passed over the falls via the open-river channel, carrying 545,221½ tons of freight, thus making the aggregate that passed Louisville via both routes 6,993 boats, barges, and small craft, and 1,716,461½ tons of freight.

(See Appendix I I 2.)

3. Wabash River, Indiana and Illinois.—At the time the United States began the work of improving this river it was badly obstructed by bars, accumulations of snags, rocky reefs, and numerous secondary channels or cut-offs, which lessened the flow of water through the main channel. Navigation was impracticable except at high stages

of water. A lock and dam has been built at Grand Rapids by the Wabash Navigation Company and a few improvements made at other places, also by private enterprise; but as none of them was of a substantial character, they rapidly deteriorated and became useless.

The original project and outline of improvements proposed is found in the report of Maj. G. Weitzel, Corps of Engineers, January 4, 1872, page 472, Annual Report of the Chief of Engineers for 1872. The first appropriation for work under this project was made by Congress June 10, 1872. This project proposed the improvement of the river from its mouth to Lafayette, Ind., by special works at 12 designated localities, the construction of a new lock and dam at Grand Rapids, and the general work of snagging and dredging. The estimated cost of the work proposed amounted to $312,672.62. Work at various places other than those mentioned in the project has been added from time to time, but no general revision of the original estimate has been made.

The river and harbor act of March 3, 1881, made separate appropriations for work above Vincennes and for work below Vincennes, thus dividing the original project, and subsequent to that date funds have been provided separately for each section.

From the commencement of the work, in 1872, to March 31, 1881, the expenditures, all of which were for work below Vincennes, amounted to $324,845.44. Those for work since that date are given under their respective headings, as follows:

(*a*) *Below Vincennes.*—Subsequent to 1881 work was continued under the original project, but the estimates were modified from time to time as necessity therefor arose, as in the cases of the dam for closing the New Harmony Cut-off, the lock and dam at Grand Rapids, etc. Levee work at Grayville, Ill., was added in 1887, and completed, as proposed, at a cost of $25,000. In 1898 a plan and estimate, amounting to $50,000, for additional work at New Harmony was approved, but at the same time it was urged that if the improvement of the river was to be continued the old project should be abrogated, a comprehensive survey of the river made, and a new project formulated, based upon data furnished by the survey and of sufficient scope to meet existing needs of commerce. The survey was authorized and funds therefor provided by the river and harbor act of June 13, 1902. The report on the survey, proposed plan for improvement, estimate of cost, and action taken in connection therewith may be found on page 2729, Annual Report of the Chief of Engineers for 1904. The aggregate of the items of the original estimate applicable to this part of the river and of the several subsequent estimates constituting the estimate of cost of existing project adopted by Congress is $755,000.

The expenditures to March 31, 1881, amounted to $317,845.44, in addition to the $7,000 paid to extinguish the franchise of the Wabash Navigation Company and acquire their property, those for the levee work at Grayville from 1887 to 1892, $25,000, and those for other work since 1881 on this part of the river, $365,111.76, or an aggregate of $714,957.20 for work below Vincennes to June 30, 1908.

Previous to 1885 a fairly good channel for boats having a draft not exceeding 2½ to 3 feet was maintained, but as the river and harbor act of July 5, 1884, made specific appropriation for a lock and dam at Grand Rapids, near Mount Carmel, Ill., the suspension of operations

elsewhere became necessary, in view of the fact that the funds available since that date were not sufficient to complete the lock and dam, and at the same time maintain the former works for bank protection and to concentrate the water flow and clear the channel of obstructions. Consequently the work formerly done deteriorated rapidly, the structures being destroyed by ice and high water or rendered useless by the water cutting its way around them. The channels, cut through rock reefs and shoal places, became choked with snags, stumps, and bowlders, thus leaving the river without any permanent improvement excepting that resulting from the lock and dam at Grand Rapids. Through navigation at low water is impracticable. Boats drawing 20 inches can pass from Mount Carmel to Vincennes (a river distance of about 34 miles) at all stages, but can reach Mount Carmel, 92.7 miles from the mouth of the river, only when the gauge at the lock reads 7.5 feet or more.

Commercial statistics will be found in the report for operating and care of lock and dam at Grand Rapids, Wabash River (Appendix I I 4).

References to more extended information are given on page 494, Annual Report of the Chief of Engineers, 1904.

The work remaining to be done under the projects and estimates so far approved is that of closing the cut-off at New Harmony, Ind.

It is not believed that the improvement has had any influence upon freight rates.

July 1, 1907, balance unexpended	$42.80
June 30, 1908, amount covered into the surplus fund of the Treasury	.26
July 1, 1908, balance unexpended	42.54
July 1, 1908, outstanding liabilities	25.75
July 1, 1908, balance available	16.79
Amount (estimated) required for completion of existing project	75,000.00

(*b*) *Above Vincennes.*—At the time this section of the river became the object of separate appropriations there had been no revision of the estimate in the original project for the improvement of the river from its mouth to Lafayette. Under the project matured after the appropriation had been made (see Annual Report of the Chief of Engineers for 1881, p. 2001), and subsequent modifications, the estimates to June 30, 1908, amounted to $95,500.

The expenditures on the work of existing project to June 30, 1908, amounted to $95,254.87.

The funds available during the past sixteen years have not been sufficient to maintain the former works for channel rectification and to keep the river clear of snags, bars, and similar obstructions. During the more recent years not enough funds have been available for snagging purposes alone. Therefore it can not be said that any permanent improvement of this section of the river has been effected or that navigation is practicable, except at high stages of water.

The only commercial statistics available are those collected at the lock at Grand Rapids. (See Appendix I I 4.) References to more extended information may be found in the Annual Report of the Chief of Engineers for 1904, page 495.

It is not believed that the improvement has had any effect on freight rates.

July 1, 1907, balance unexpended	$245.13
July 1, 1908, balance unexpended	245.13

(See Appendix I I 3.)

4. Operating and care of lock and dam at Grand Rapids, Wabash River.—This lock and dam was built from funds derived from appropriations for improving Wabash River, Indiana and Illinois, and opened to navigation in November, 1893. The available length of the lock is 214 feet; width, 52 feet; depth on lower miter sill at low water, 3.5 feet; depth on upper miter sill at normal pool stage, 5.08 feet. At such stage the pool above the lock affords slack-water navigation about 12 miles, and the maximum draft that can be carried is about 2 feet. Conditions beyond the pool are mentioned in the report for improving Wabash River, Indiana and Illinois.

The expenses of operating the lock were paid from the appropriations for improvement of the river until March 1, 1897, since which date they have been paid from annual allotments from the indefinite appropriation for "Operating and care of canals and other works of navigation," act of July 5, 1884.

The first and subsequent annual projects proposed the operation of the lock and the maintenance of it and the appurtenant structures in good serviceable condition. The expenditures under these projects to June 30, 1908, amounted to $32,427.40.

The project for the fiscal year 1908 provided for the operation of the lock, dredging in and above lock chamber, minor repairs to dam, and miscellaneous current repairs to buildings, fences, etc., at an estimated cost of $2,900, which amount was made available by allotment July 5, 1907. The amount expended during the fiscal year ending June 30, 1908, not including outstanding liabilities, is $1,117.

During the past fiscal year 1,697 boats, barges, etc., and 5,155½ tons of freight passed the lock.

A comparative statement of traffic and commerce passing this lock during the past eleven years will be found in the report on this work by the district officer.

(See Appendix I I 4.)

5. White River, Indiana.—Originally this tributary to Wabash River was badly obstructed by rocky reefs, remains of old structures, and a very great number of snags. It could be navigated only at high stages of water.

The original project is based upon the report of "examination of White River and its forks in Indiana," submitted December 31, 1878. The first appropriation for the improvement was made in the act of March 3, 1879. In this act the work of improvement was limited to "White River, Indiana, from Wabash River to Portersville, and to the falls on the West Fork, according to Report of the Chief of Engineers, without constructing locks and dams." A minimum depth of 2 feet at low water was sought. In 1886 the estimate was reduced. The river and harbor act of August 18, 1894, provided for a resurvey of the river.

Subject to the modifications mentioned, the original project constitutes the existing project of this date. The estimate of cost is

$120,000. The amount expended to June 30, 1908, not including outstanding liabilities, is $119,296.18. As a result of these expenditures the lower 13 miles of the river is navigable all the year for boats having a draft not exceeding 3 feet. Above this, to the junction of the two forks, boats drawing 18 inches can navigate for about six months of the year. Low-water navigation on the forks is impracticable even for the smallest boats. This information is derived from the report on the resurvey made in 1895-96, since which date operations have been suspended, the funds available not being sufficient for either work of improvement or maintenance of former structures for controlling the flow of water and bank protection or to keep the channel clear of snags.

No statistics as to the volume or character of commerce moved on this river during the past year are available.

The report upon the resurvey of the river (Annual Report of the Chief of Engineers for 1897, p. 2483) contains data concerning the volume and character of commerce that would be benefited by or involved in the further improvement of the river. This report also contains estimates of cost of improvement under alternative plans and a recommendation that "the further improvement of the White River should be postponed until the improvement of the Wabash has been such as to afford an outlet for any traffic which may then be developed on White River."

References to more extended information concerning this river may be found in Annual Report of the Chief of Engineers for 1904, page 497.

July 1, 1907, balance unexpended	$703.82
July 1, 1908, balance unexpended	703.82

(See Appendix I I 5.)

6. *Green River, above the mouth of Big Barren River, Kentucky.*—Originally this part of Green River was much obstructed by snags, large bowlders, and overhanging trees. Dam No. 4, Green River, afforded slack water for about 18 miles above the confluence of Green and Barren rivers. The fall in that part of the river above slack water and below Mammoth Cave, Ky., a distance of about 29 miles, was approximately 27 feet.

The original project is that submitted under date of August 11, 1891 (printed in Annual Report of the Chief of Engineers for 1891, p. 2481). It proposes the extension of slack-water navigation from the upper limits of pool No. 4 to Mammoth Cave by the construction of two locks and dams at an estimated cost of $361,346.40 for both. No revision of the project and estimate has been made except as provided by the river and harbor act of March 3, 1905, for work of snagging and clearing banks of Nolin River, which will be affected by slack water from Dam No. 6, Green River, for which $5,000 has been appropriated.

The amount expended to June 30, 1908, exclusive of outstanding liabilities on that date, is $365,093.03.

As a result of these expenditures Locks and Dams Nos. 5 and 6 have been completed and opened to navigation, thus extending slack water to Mammoth Cave, Ky., and through a part of the rich mineral district bordering the river which previously had no conveniently accessible transportation route.

Commercial statistics are given in the report for operating and care of locks and dams on Green and Barren rivers, Kentucky (Appendix I I 7).

References to more extended information may be found in Annual Report of the Chief of Engineers for 1904, page 498.

Report of examination of the river from Lock No. 6 to Munfordville may be found in House Document No. 377, Fifty-ninth Congress, first session.

Sufficient data are not available upon which to determine the effect of the improvement on freight rates, if any.

July 1, 1907, balance unexpended	$580.17
July 1, 1908, balance unexpended	580.17

(See Appendix I I 6.)

7. *Operating and care of locks and dams on Green and Barren rivers, Kentucky.*—The original system of slack-water navigation on these rivers, including 4 locks in Green River and 1 lock in Barren River, with a total length of pools of approximately 200 miles, was completed by the State of Kentucky in 1841. The State retained control and management of the system until 1868, when it was leased to the Green and Barren River Navigation Company for a term of thirty years. The act of the Kentucky legislature, approved February 20, 1886, ceded the entire system to the United States upon condition that the unexpired portion of the lease to the navigation company be purchased by the United States. The river and harbor act of August 11, 1888, appropriated $135,000 "for the purchase of the improvements known as the Green and Barren River improvements." The deed from the Green and Barren River Navigation Company relinquishing all their rights, privileges, etc., having been duly approved by the Attorney-General of the United States, and the purchase money paid to said company, the Government assumed control of the river, the improvements therein, and the property formerly owned by the State, December 11, 1888.

The condition of the improvements and of the rivers at that date was as follows: Lock and Dam No. 1, Green River, required many repairs. The walls of Lock No. 2 were cracked and in bad condition generally, the land wall especially so, it being held in position by anchorage to cribs filled with stone; the river wall had yielded outward. Lock No. 3, Green River, was broken entirely, the river wall having yielded outward and fallen into the river. Lock and Dam No. 4, Green River, was in fairly good condition, with the exception of needed repairs to the quoins and gates. The walls of Lock No. 1, Barren River, were so badly cracked that a part of one of them, the land wall, leaned toward the lock chamber about 6 inches and was liable to fall at any time. The entrances to the locks were obstructed with deposit and the pools with great numbers of snags, overhanging trees, etc.; the appurtenant structures at the locks and the lock-tenders' dwellings were in bad condition and inadequate. No snagging or dredging plant was available.

Excepting the funds for rebuilding Lock No. 2, Green River, which were provided by specific appropriations, the funds for the restoration of former structures, the operation of the locks, and maintenance of the system in good navigable condition have been provided by allotments from the indefinite appropriation for "Operating and care of

canals and other works of navigation," act of July 5, 1884, under estimates submitted annually at the beginning of each fiscal year. The first project for work on these rivers under the latter act was approved January 4, 1889, and proposed the restoration, so far as practicable, of the former structures to good serviceable condition, the construction of new ones where required, the operation of the locks, the removal of snags, landslides, and deposit from the entrances to the locks, etc., and such has been the general object of each subsequent annual estimate and project.

In addition to the items for the usual work of operation and maintenance, the project and estimate for the fiscal year 1908 provided for rebuilding with concrete of the above-water portions of the upper river crib at Lock No. 4, Green River; the rebuilding with concrete of 70 feet of lower-shore crib at Lock No. 4, Green River; repairs to Lock No. 5, Green River; extending bank protection below Lock No. 6, Green River; construction of a concrete lower crib 40 feet long at Lock No. 1, Barren River; completion of two barges; construction of a new steel hull for the snag boat and various repairs of less important nature to the other structures and floating plant. The estimate for the fiscal year amounted to $139,952.82, which was made available by allotments of July 22, 1907, and September 21, 1907.

Expenditures during the fiscal year, not including outstanding liabilities June 30, 1908, amounted to $96,601.49.

The aggregate expenditures under the project of January 4, 1889, and subsequent annual projects to June 30, 1908, is $1,369,918.10.

The result of these expenditures is the thorough repair of the several locks of the former system and their appurtenant structures, and the restoration of through navigation in the pools from Lock No. 1, Green River, to Bowling Green, Ky., on Barren River, a distance of 172 miles, for boats not exceeding 35 feet in width, 138 feet in length, and draft not exceeding 5 feet.

At extreme low water in the open river below Lock No. 1, Green River, there is a depth of only 1 foot on the lower miter sill of that lock, which is located 8 miles above the mouth of the river. The system now includes 7 locks and dams. Locks Nos. 5 and 6, Green River, having been built from funds provided by specific appropriations.

Following is a synopsis of traffic and commerce through the locks during the fiscal year:

	Boats.	Freight.
Green River—		*Tons.*
Lock No. 1	5,456	476,274
Lock No. 2	3,156	353,269
Lock No. 3	3,312	293,882
Lock No. 4	2,510	167,274
Lock No. 5	1,466	108,887
Lock No. 6	1,503	65,309
Barren River, Lock No. 1	1,348	37,201

A comparative statement of the traffic and commerce on these rivers will be found in the report on this work by the district officer.

References to more extended information may be found in Annual Report of the Chief of Engineers for 1904, page 500.

(See Appendix I I 7.)

8. Rough River, Kentucky.—Originally this river was much obstructed by snags, sunken logs, stumps, bowlders and bars in the bed of the stream, and by overhanging trees on its banks. Backwater from Dam No. 2, Green River, affected 8 miles of the river above its confluence with Green River. The width of the river varied from about 100 to 200 feet, and the movement of commerce was limited to periods of high water. A timber-crib lock and dam had been built on the river about 7 miles above Livermore, Ky., by the Rough Creek Navigation and Manufacturing Company, but at the time the United States undertook the improvement of the river the structures had been abandoned and were completely in ruins, and all rights, powers, and privileges granted said company by the State legislature annulled.

The original project is found in the report of Maj. James C. Post, Corps of Engineers, dated January 27, 1885, page 1894, Annual Report of the Chief of Engineers for 1885, and was adopted by Congress in the river and harbor act of September 19, 1890, and has for its object the extension of slack-water navigation to Hartford, Ky., by the construction of a lock and dam and clearing the stream of snags, overhanging trees, and other obstructions. A revision of the project, so far as it relates to the estimate, dimensions of lock and dam, and the number and kind of other structures necessary in connection with the lock, was made August 31, 1891. A further modification in 1895 substituted concrete for stone in the construction of the lock and provided for minor changes in the dimensions previously proposed.

The existing project is the same as that outlined in the preceding paragraph, the revised estimate of August 31, 1891, amounting to $105,556.05. Expenditures on the work of existing project up to the close of the fiscal year ending June 30, 1908, not including outstanding liabilities, amounted to $105,482.73.

The lock, dam, and appurtenant structures have been completed. The lock was opened to navigation December 12, 1896. The maximum depth that can be carried at the upper end of the pool above the lock at normal pool stage is about 4 feet; the depth on the upper miter sill at such stage is 6.8 feet. The available length of the lock is 123 feet and available width 27 feet. At low water the head of navigation is a short distance above Hartford, Ky., or about 29½ miles above the mouth of the river and 21½ miles above the lock. Beyond this navigation is practicable only at high stages of the river, and consists principally of rafts and rowboats.

References to more extended information may be found in Annual Report of the Chief of Engineers, 1904, page 501.

Sufficient data are not available upon which to determine the effect of the improvement on freight rates, if any.

Commercial statistics are given in the report for operating and care of lock and dam on Rough River, Kentucky (Appendix I I 9).

In view of the fact that the work proposed by the project for the improvement of this river has been completed and no further work of improvement projected or recommended, the unexpended balance, $17.27, which amount represents the amount of old outstanding liabilities, has been deposited to the credit of the Treasurer of the United States. Therefore no further report concerning this im-

provement will appear unless subsequent projects are adopted and appropriations therefor made available.

July 1, 1907, balance unexpended		$106.79
June 30, 1908, amount expended during fiscal year, for maintenance of improvement	$89.52	
June 30, 1908, balance covered into surplus fund of the Treasury	17.27	
		106.79

(See Appendix I I 8.)

9. Operating and care of lock and dam on Rough River, Kentucky.—This lock and dam was built with funds provided in appropriations for improving Rough River, Kentucky, and opened to navigation December 12, 1896. The lock has an available length of 123 feet, width of 27 feet, and depth on upper miter sill at normal pool stage of 6.8 feet. At such stage the pool above the lock affords slack-water navigation 21½ miles to a short distance above Hartford, Ky., for boats with draft not exceeding 4 feet.

The expense of operating the lock was paid from the appropriation for improvement until June 30, 1897; since that date the expenses of operating, care, etc., have been borne by the indefinite appropriation for operating and care of canals and other works of navigation, act of July 5, 1884, the funds being made available by allotment for projects and estimates submitted annually at the beginning of each fiscal year.

The project for the fiscal year 1908 proposed to operate the lock and maintain existing structures in good serviceable condition, keep the pools clear of snags, and remove deposits from the lock and approaches thereto at an estimated cost of $1,708; which amount was made available by allotment July 12, 1907.

Expenditures during the year amounted to $904.15.

The amount expended from July 1, 1897, to June 30, 1908, not including outstanding liabilities, is $9,635.46.

Traffic through the lock during the past fiscal year included 920 boats of various kinds, carrying 37,163 tons of freight.

A comparative statement of traffic and commerce on this river during the past seventeen years will be found in the report on this work by the district officer.

(See Appendix I I 9.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE DULUTH, MINNESOTA, DISTRICT.

This district was in the charge of Maj. Graham D. Fitch, Corps of Engineers. Division engineer, Col. W. H. Bixby, Corps of Engineers, to February 15, 1908, and Lieut. Col. W. L. Fisk, Corps of Engineers, since that date.

1. Harbor at Grand Marais, Minn.—This harbor is an elliptical bay, whose major axis is about one-half mile and whose minor axis is about one-fourth of a mile in length. It has an opening on the south side, which was originally about 1,000 feet in width. Before improvement there was a maximum depth of 14 feet over a very limited area, the general average depth being only 8 or 9 feet. It is the only harbor of refuge on the north shore between Agate Bay and the international boundary line, a distance of 125 miles.

The approved project of April, 1879, is to build two breakwater piers, each 350 feet long, from the east and west points of the bay, or

one pier 700 feet long from the east point, and dredge an anchorage area of about 26 acres to a depth of at least 16 feet, all at an estimated cost of $139,669.40. For reasons explained in the report of the local officer (Annual Report of the Chief of Engineers for 1898, p. 2217), this estimate was increased to $163,954.63.

Two breakwaters, each 350 feet long, have been constructed from the east and west points of the bay, the work being completed on August 13, 1901.

The amount expended on the project up to the close of the fiscal year ending June 30, 1908, not including outstanding liabilities, was $166,270.98, of which about $5,334.30 was for maintenance. The work done has resulted in a more protected harbor and a 16-foot anchorage area of about 26 acres.

The expenditures during the year were for incidental expenses and contingencies.

The minimum mean low-water depth over the shoalest part of the locality under improvement is 15 feet.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

The commerce of the port has increased from 25 entrances and clearances, made by 4 tugs and 5 schooners, with 60 tons of cargo, valued at $6,000, in 1878, to 1,176 clearances and entrances, nearly all steamers, with 48,185 tons of cargo, valued at $1,471,555, in 1907.

The value of the commerce of the harbor from 1878 to 1907, both inclusive, is estimated at $9,362,034.

The freight tonnage in 1907 was 56 per cent greater than in 1906.

Effect of project on freight rates: There are no railroads running to this harbor, and the only means of transportation is by water, so that no comparison can be made with railroad charges.

In the original condition of the bay a small commercial business could have been transacted by means of tugs or other vessels of small draft at risk of exposure to storms, and logs could have been rafted to other ports on the lake, also at risk of loss, to be sawed into lumber; but the present commerce of this port could not have been carried on.

The United States improvements have therefore been an indispensable agency in the development of business where none previously existed, and this may be of greater value and importance than a simple reduction of rates.

The available balance and the appropriation recommended will be expended for repairs and maintenance as necessity arises.

For reports of examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 559, where references are given; also page 648 of this report.

July 1, 1907, balance unexpended	$6,663.32
June 30, 1908, amount expended during fiscal year for maintenance of improvement	584.30
July 1, 1908, balance unexpended	6,079.02
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix J J 1.)

2. Harbor at Agate Bay, Minnesota.—This harbor, situated on the north shore of Lake Superior, 27 miles northeast of Duluth, Minn., is an important shipping port for iron ore and lumber and a harbor of refuge.

Before improvement there was ample depth for navigation, but the harbor was exposed to storms from the southwest and to reverse swells from severe northeast storms.

The approved project of January 4, 1887, was to construct two breakwater piers on a line toward each other from the eastern and western points of the bay, to be 1,000 and 900 feet long, respectively, leaving an opening of 1,340 feet between their extremities and inclosing an area of 109 acres.

By authority of the Chief of Engineers of March 23, 1899, the total ultimate length of the easterly breakwater was increased by 50 feet.

The original estimate of cost was $213,000, which was increased to $244,208 (see Annual Report of the Chief of Engineers for 1887) on account of higher prices.

The amount expended on the approved project up to the close of the fiscal year ending June 30, 1908, not including outstanding liabilities, was $250,880.07, of which about $16,822.54, was applied to the maintenance of the improvement.

The project was completed on November 1, 1901, and fulfills very effectually the purpose for which it was designed.

The amount expended during the year was for incidental expenses and contingencies.

The depth at the entrance is over 50 feet, and vessels drawing 20 feet can reach the ore docks in safety.

The usual variation of water level extends from about 0 to about +1 foot above low-water datum.

The commerce of the port has increased from 174 arrivals and clearances of vessels in 1885, with 263,437 tons of freight, valued at $876,613, to 3,520 arrivals and clearances in 1907, with 9,571,752 tons, valued at $26,780,191.

The total value of the commerce of this port from 1887 to 1907, both years inclusive, is $187,570,368.

Effect of project on freight rates: It is estimated that the saving in cost of transportation by water as compared with that by rail for the receipts and shipments of this harbor is approximately $1.82 per ton, which amounts to $17,400,000 for the year 1907. This is more than one-half of the value of the receipts and shipments for the same year. The Government improvements have been an indispensable aid to this commerce. (See the following report for harbor at Duluth, Minn., and Superior, Wis.)

The available balance and the appropriation recommended will be expended for repairs and maintenance.

For reports of examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 561, where references are given.

July 1, 1907, balance unexpended	$2,116.66
Received as compensation for damages	[a] 4,012.50
	6,129.16
June 30, 1908, amount expended during fiscal year for maintenance of improvement	222.54
July 1, 1908, balance unexpended	5,906.62
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix J J 2.)

3. Harbor at Duluth, Minn., and Superior, Wis.—Previous to the Annual Report of 1897 this harbor was reported on under the separate heads of Duluth, Minn., and Superior, Wis., respectively.

The act of June 3, 1896, unified these harbors under the above title and provided for continuous contracts for its improvement to the amount of $3,130,553.

This harbor consists of the Duluth Canal, the Wisconsin Entrance, Superior Bay, Allouez Bay, St. Louis Bay, and St. Louis River to the limits of the cities of Duluth and Superior, about 20 miles from the original natural entry, which before improvement was obstructed by shifting bars with but 9 feet of water over them. The bays were broad expanses of shallow water, averaging only 8 or 9 feet, except along a natural channel through them where the depth was greater, but variable.

The project adopted by the act of March 3, 1881, previous to the present one, was for 16-foot navigation. This was practically completed July 1, 1897, and resulted in giving a good 16-foot navigation through the natural or Wisconsin Entry; through the artificial Duluth Canal; over the Duluth Basin of 104 acres; along and parallel to the principal dock lines of Duluth and Superior in Superior and St. Louis bays, and up the St. Louis River to New Duluth, near the head of navigation of the river, with well-defined channels of from 85 to 300 feet in width.

The amount expended on the project of March 3, 1881, and projects prior to operations under existing project was $1,548,183.

The present project, authorized by the act of June 3, 1896, and by the modifications of August 14, 1896, and May 9, 1901, provided for the widening and deepening to a navigable depth of 20 feet of the existing channels, for new channels in Allouez Bay and St. Louis River, for extensive turning and anchorage basins of a navigable depth of 20 feet at the junctions of two or more channels, for widening the Duluth Canal, and for rebuilding the piers at the Duluth Canal and Wisconsin Entrance and finishing them off with concrete superstructures built of monolithic blocks.

The estimated cost of the work was $3,130,553, but this referred only to the deepening of the channels and basins by dredging. This

[a] Four thousand and twelve dollars and fifty cents deposited with Treasury September 6, 1907, account judgment against the Davidson Steamship Company for damages to the breakwater in 1902 by the steamer *Shenandoah*.

has been done at much less than the estimated cost, permitting the purchase of lands to the extent of $106,561.19, the rebuilding of the Duluth Canal piers at a cost of over $650,000, including price of land, and leaving a balance of about $275,000 toward the rebuilding of the piers at the Wisconsin Entrance under construction from 1903 to 1906.

The present project has been further modified and enlarged by the act of March 2, 1907, in accordance with the report submitted in House Document No. 82, Fifty-ninth Congress, second session, which provides for excavation of the lake approach to the Duluth entrance to 30 feet for a width of 300 feet at a cost of $10,000, and the following work at Superior Entry: (a) Building a concrete revetment pier on the north side of entrance, similar to one already built in 1904, on the south side under the project before present modification, these two revetments 500 feet apart and terminating near the lake shore of Wisconsin Point; (b) building two converging breakwaters from the shore out to the 30-foot depth, with an opening of 600 feet on line with the axis of the inner entrance, to be of rubble mound construction, terminating in a crib and concrete pier at outer end and a pile pier at inner end; (c) dredging between the breakwaters to form a channel 600 feet wide and 30 feet deep, and further dredging to form a stilling basin; (d) dredging channel between revetments to a depth of 24 feet; (e) protecting the shore line by riprap; and (f) widening the Superior front channel inside the harbor; estimated to cost $1,703,000. The said act also provided for additional dredging near the draw span of the Northern Pacific Railroad bridge at an estimated cost of $55,500.

The present project has been further modified and enlarged by the act of May 28, 1908, which provides for the expenditure of moneys heretofore appropriated for the harbor for dredging inside the Duluth entrance, in accordance with a report in House Document No. 221, Sixtieth Congress, first session. This report recommended the enlargement by about 209 acres of the anchorage area of the Duluth Basin, by dredging to a depth of 22 feet, low-water datum, an estimated amount of 4,590,000 yards, at a cost of $550,800. These several modifications have a combined estimated cost of $2,319,300, and together with the first estimate of $3,130,553 makes a total estimated cost of $5,449,853 for the present project and its modifications.

The amount expended on the existing project to the close of the fiscal year ending June 30, 1908, exclusive of outstanding liabilities, was $3,865,484.78, of which $426,030 was expended for maintenance.

The work done under the existing project up to the close of the past fiscal year has been as follows:

The dredging of channels and basins, which was in operation for six seasons under continuous contract and completed in 1902, removed 21,697,243 yards of material, and gave 17 miles of dredged channels from 120 to 600 feet in width, and basins for anchorage and for turning at the junctions of channels and in the vicinity of bridges of an aggregate area of about 360 acres, all of a depth of 20 feet or more at low water. The lake approach to the Duluth Canal has been deepened to 30 feet or more for a width of 330 feet. The lake approach to the Superior Entry has been deepened to 30 feet

or more for a width of 350 feet. Channels have been widened in St. Louis Bay to adapt them to the reconstructed spans of the Northern Pacific bridge, which have recently been enlarged and altered in position.

The maintenance of these channels has been kept up by the removal of shoals, and a maximum draft of 20 feet at mean low water could be carried through any and all of them on June 30, 1908. The usual variation of water level extends from about 0 to +1 foot above low-water datum. The head of navigation is at the foot of the rapids just above the village of Fond du Lac, on the St. Louis River, about 20 miles from Lake Superior.

All the land necessary for the widening of the Duluth Canal has been acquired by deed of gift, purchase, or condemnation, at a cost of $53,919.05.

The land needed for the improvement at the Wisconsin Entrance, the mouth of the Nemadji River, and on a marshy island in the St. Louis River, was obtained by condemnation proceedings, at a cost of $42,795.94.

A small parcel of land at the end of Grassy Point and certain lands in Spirit Lake were purchased, at a cost of $3,146.20.

A site for a boat yard on Minnesota Point, near the Duluth Canal, was acquired by purchase and condemnation, at a total cost of $7,200, and the vacation of a portion of a street was effected through the city authorities, which was found necessary in order to carry out a proper system of improvement. This property has now been improved by building a bulkhead and a landing pier, dredging a slip, filling the yard with sand, moving the four Government buildings, which had been occupying leased ground at the foot of Seventh avenue for the last seven years, and by fencing in, paving a roadway, and surfacing and seeding for grass. The cost of this improvement has been about $17,750.

New piers were built for the Duluth Canal. These piers have been equipped with 67 iron lamp-posts, and the city furnishes the electric current for lighting the same during the season of passenger travel by lake.

Concrete walls inclosing the Government lands at the Duluth Canal were built and the tracts filled to grade, requiring the deposit of about 50,000 cubic yards of material.

The construction of an engineer building on the Government land north of the canal for offices and a watchman's house has been completed, at a cost of about $25,000. On May 1, 1906, the rented office rooms were given up and the new building occupied. It is a substantial building, conveniently near the harbor and United States vessel yard, and well adapted to office purposes. The parking of the canal grounds and the construction of additional concrete walls to protect the grounds from flooding by storms have been completed.

At the Wisconsin Entrance (known also as the Superior Entry) the replacing of the old piers by new ones of concrete construction was begun in 1903. About one-half of the south pier was completed in 1904. A description of the method of construction may be seen in Appendix A A A, page 3779, of the Annual Report of the Chief of Engineers for 1904. During the following two years but little was

accomplished in the way of construction at the Superior Entry on account of the destruction of protective works by storms. Work on the concrete piers was ordered discontinued by the Chief of Engineers August 21, 1906, pending the consideration of a report by a board of engineers.

Work on the modified project, in accordance with the act of March 2, 1907, was commenced in the spring of 1907, and has been in progress since that time. The results accomplished are as follows: On the north concrete revetment work the trench has been excavated for nearly the entire length, a pile pier built for a protection to the operations on the site, also accessory structures consisting of trestles, tracks, the removal of buildings from the south side to the north side of the Entry for offices, shops, and storage, and the construction of 400 linear feet of the concrete revetment at the harbor end.

On the breakwater work a framing mill and other plant has been installed for the construction of the timber and concrete piers at the seaward ends of the breakwaters; three of the large cribs have been completed and three more partially completed. A number of the 10-ton concrete footing blocks have been built. The Government derrick has excavated 10,492 tons of large riprap from the base of the old piers and placed it in the rubble mound of the south breakwater to form a part of that structure. The foregoing items of work have been by hired labor and purchase of materials. The north rubble mound is being constructed under contract, and 3½ per cent of the entire mound was in place by June 30, 1908. The dredging of the lake approach to the Entry to a depth of 30 feet (stated elsewhere) forms part of the foregoing project.

The lake commerce of this port, Duluth-Superior, during the last season of navigation amounted to 34,786,705 tons (of 2,000 pounds), valued at $287,529,694, and from the beginning of improvements by the Government in 1867 to 1907, inclusive, the vessel freight entering and departing has amounted to 242,181,972 tons (of 2,000 pounds), valued at $2,880,665,300.

It is believed that the tonnage of Duluth-Superior Harbor is now exceeded by that of but two ports in the United States—New York and Philadelphia.

The vessel freight of Duluth-Superior Harbor for 1907 was 60 per cent of the amount which passed the Sault locks the same year.

For a comparison between the cost of improvements and the volume of commerce, it may be stated here that the total amount of money expended by the Government on the improvement of this harbor from the commencement of work in 1867 up to 1907, inclusive, is $5,413,667.78. The vessel freight received and shipped at this port during the same period was 242,181,972 tons, and its market value was $2,880,665,300. From this it appears that the cost of Government improvements has been less than one-fifth of 1 per cent of the value of the freight transported.

Effect of project on freight rates: It may not be possible to give exact figures showing the effect of the improvements of this harbor on freight rates, but the following statements have a bearing on the question:

The average rate on freight passing through St. Marys Falls canals in 1907 was 0.80 mill per mile per ton, and the average haul was 828.3 miles, as shown by the official records. If the same freight had been carried by rail, the rate would probably have been as much as 3 mills per ton-mile, making a difference of 2.2 mills per ton-mile.

Assuming this difference to apply to freight for Duluth-Superior Harbor and that the average haul is 828.3 miles, the saving in cost of transportation by water would be $1.82 per ton, and for the 34,786,705 tons received and shipped at this harbor in 1907 the saving in cost amounts to $63,000,000 in that one year.

The saving in cost of this large sum has, of course, been made possible by the Government improvements, not only at this harbor, but at St. Marys River and at other points between here and the Lake Erie ports, and it is not known just how much of the above saving should be credited to the Duluth-Superior improvements. It is evident, however, that with any reasonable proportion of such saving in transportation accredited to the improvements at this harbor, which form an essential and necessary part of the whole waterway, the cost of such improvements must be only a small fraction of the saving in freight rates effected thereby.[a]

The foregoing saving to shippers is based upon a comparison of existing rates of transportation by water and rail. In addition to this it should be said that the rail rates are reduced or kept down by the competition of the waterway, and in that way a further saving in transportation is effected. The two modes of transportation having developed contemporaneously during the last half century, it would be hard to say what the railroad rates would be if the Great Lakes waterway with its Government improvements did not exist, but there is hardly room for doubt that they would be materially higher.

For example, the railroads along the south shore of Lake Superior reduce their rates during the season of navigation in order to compete with the lake lines of vessels. Thus the Northern Pacific makes a rate from Duluth to Ashland practically the same as by the Booth line of steamers, and the South Shore road makes a rate from Duluth to Marquette only about 2 cents per hundred higher than by lake. On business between Duluth and the Lake Erie ports, however, the railroads say they can not afford to compete with lake rates, and their rates are not changed during the summer.

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[a] A similar saving in freight rates applies to other harbors in the Duluth district which have railroad connections and where harbor improvements executed by the Government (or in part at private cost) have opened up these harbors to interlake navigation and commerce. The above-named amount of saving in cost of transportation, $1.82 per ton, will be considered as also applying approximately to the harbors of Agate Bay, Ashland, Ontonagon, Marquette, Marquette Bay, Grand Marais (Mich.), and the local harbors of the Keweenaw waterway, subject to more or less error, according to different local conditions, such as the class of freight, its destination, number of competing railroads, facility of handling freight by boat and by rail, etc. A complete analysis of the subject can not, however, be given in this report.

The amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, consists of the following items:

(*a*) Continuing improvements at the Superior Entry, the work proposed being necessary to make the improvement available, as follows:	
Completing the rubble mound portions of the two breakwaters	$458,776.00
Building the piers at seaward end of breakwaters up to the water surface, including footing blocks	117,650.00
Completing the north concrete revetment	106,750.00
Removing the riprap and a portion of the old timber piers	30,000.00
Dredging north side inner channel	64,368.00
	777,544.00
Administration and contingencies, 20 per cent	155,509.00
	933,053.00
(*b*) Enlarging the Duluth anchorage basin, to the extent of the area recommended by the report in House Document No. 221, Sixtieth Congress, first session, this being an extension of present benefits, estimate including administration and contingencies	550,800.00
(*c*) Contract work unpaid on work of widening channels in St. Louis Bay, etc	25,000.00
Total for works of improvement	1,508,853.00
Deduct balance unexpended July 1, 1908	762,735.00
Amount in addition to balance unexpended July 1, 1908	746,118.00
(*d*) Maintenance (this includes the removal of shoals, repairs to piers, care of parks, patrol of harbor, etc.)	51,000.00

With regard to the maintenance of improvements in this harbor, it is believed that this could be advantageously provided for by an annual allotment.

With 49 miles of harbor frontage, 17 miles of 20-foot channels, and the handling of over 34,000,000 tons of freight in the past year, there is necessity for the closest inspection, by a special patrol provided with a steam tug, to prevent injurious deposits, encroachments of wharves and other private structures, the enforcement of rules regarding the rafting of logs, the anchorage of vessels, the opening of draws, and the care of United States property. These, with the discovery and removal of shoals, repairs to Government piers, the care of parks, and the collection of complete and reliable commercial statistics, which has already proven of great value, it is thought could best be cared for by Congressional action authorizing allotments or appropriations to be made on estimates submitted.

A Board of Engineers convened July 23, 1906, at Duluth, with a view to determining what modifications, if any, should be made in the present plan of improvement. The report is printed in House Document No. 82, Fifty-ninth Congress, second session.

Reference to reports on examination and survey made in compliance with act of March 2, 1907, will be found on page 648 of this report.

For other reports of examinations and surveys of Duluth-Superior Harbor, see the Annual Report of the Chief of Engineers for 1906, page 565, where references are given.

July 1, 1907, balance unexpended		$1,154,805.58
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$311,639.76	
For maintenance of improvement	80,430.10	
		392,069.86
July 1, 1908, balance unexpended		762,735.72
July 1, 1908, outstanding liabilities		56,130.47
July 1, 1908, balance available		706,605.25
July 1, 1908, amount covered by uncompleted contracts		285,000.00
Amount (estimated) required for completion of existing project		1,378,799.20
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		797,000.00

(See Appendix J J 3.)

4. Harbor at Port Wing, Wis.—The harbor of Port Wing, formed by the mouth of Flag River, is situated on the south shore of Lake Superior, about 33 miles from the head of the lake.

Before improvement the depth at entrance was small and variable.

Previous to Government operations the harbor had been improved by private parties to some extent. The entrance had been jettied, but imperfectly and with only partial success, and dredging was necessary every spring for removing a sand bar. Within the harbor much dredging had been done to accommodate the lumber business.

In accordance with the provisions of the act of Congress approved March 3, 1899, a report upon a survey of this harbor with a project for its improvement was submitted on November 20, 1899.

This project provided for the construction of two parallel piers of piling, filled in with slabs and topped with large rock. These piers were to be located 200 feet apart and to be 800 feet and 825 feet long, respectively. A channel 150 feet wide and 15 feet deep was to be dredged between the piers and for 500 feet along the slough. The estimated cost of the improvement was $44,992, increased in this report to $56,539, on account of underestimate for dredging in the original estimate.

The amount expended on this work to the close of the fiscal year ending June 30, 1908, exclusive of outstanding liabilities, was $46,991.66, of which $5,689.71 was for maintenance.

By act of Congress approved June 13, 1902, this project was adopted; the village of Port Wing conveyed to the United States without cost 7 acres of land at the harbor entrance needed for the improvement, and the work of improvement was commenced in 1903. The following results have been accomplished: The two entrance piers built, with lengths of 800 and 601 feet, respectively; 45 feet of pile revetment at the inner end of the east pier; dredging which gave an entrance channel 15 feet deep at low water, 100 feet wide, and extending from deep water in the lake through to a distance of 100 feet inside of the inner end of the east pier; a portion of the turning slip, extending 70 feet to the east, past the inner end of the east pier, with a width of 80 feet and a depth of 14 to 16 feet; a pile revetment 100

feet long at the inner end of the west pier, and maintenance of improvement by dredging of shoals and repairs to the piers.

The latest soundings, taken April 22, 1908, show that a maximum draft of 14 feet can be carried at mean low water over the shoalest portion under improvement. The effective width for this draft is 80 to 90 feet. The usual variation of water level extends from mean low water (low-water datum) to 1 foot above datum. The entrance piers have been effective in reducing shoaling very materially.

Private dredging extended a navigable channel to a distance of about 2,500 feet southerly from the entrance, and this improvement marked the limit of navigation on Flag River. This stretch of river has been redredged from time to time by private enterprise, and the lower portion has an available depth of 12 feet for a distance of something like 900 feet from the entrance, while the upper portion is now badly shoaled.

The vessel freight of this harbor has increased from 64 arrivals and departures, with 31,127 tons (of 2,000 pounds), valued at $305,000, in 1901, to 160 arrivals and departures, with 106,971 tons (of 2,000 pounds), valued at $973,660, in 1907.

The freight tonnage in 1907 was 274 per cent greater than for the previous year.

The total freight of this port for seven years—1901 to 1907, inclusive—was 348,044 tons (of 2,000 pounds), valued at $4,143,416.

Effect of project on freight rates: This harbor has only water transportation for the movement of its freight, and for this reason no comparison can be made with freight charges by railroad.

The construction of a harbor here has been an essential factor in the development of the commerce of Port Wing. There was no commerce to mention previous to these improvements. In 1907 it amounted to nearly a million dollars.

The principal sawmill of this place, which had shut down in June, 1905, as noted in the Annual Report of the Chief of Engineers for 1905, page 1990, resumed operations in the spring of 1907, with a prospect for continuous work for many years. Other timber products and a good brownstone quarry add materially to the vessel business. The total expenditures by the Government for this harbor to date are only 1.1 per cent of the value of the vessel freight received and shipped during the period covered by these expenditures.

A revised estimate gives $15,237 as the amount required for completing the approved project. Details may be seen in the report of the district officer.

It is proposed to expend the sum recommended to be appropriated for this harbor for the completion of the project, consisting mainly of dredging to give full dimensions of channels, and for maintenance in removing shoals and for repairs to the entrance piers. These expenditures will result in an extension of the benefits to navigation.

A more detailed description of the harbor may be seen in House Document No. 114, Fifty-sixth Congress, first session, and in Bulletin No. 18, Survey of the Northern and Northwestern Lakes, page 75.

For reports on examinations and surveys, see Annual Report of the Chief Engineers for 1906, page 568, where references are given.

July 1, 1907, balance unexpended	$4,978.05
June 30, 1908, amount expended during fiscal year for maintenance of improvement	4,977.71
July 1, 1908, balance unexpended	.34
Amount (estimated) required for completion of existing project	15,237.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	20,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix J J 4.)

5. Harbor at Ashland, Wis.—Ashland Harbor is located at the head of Chequamegon Bay, and originally had no protection from the waves which rolled into the bay nor from waves generated within the bay itself by storms.

The original project, approved December 7, 1888, and modified February 9, 1889, was for the construction of a pile, slab, and rock breakwater 8,000 feet long, and for dredging a channel in front of the wharves of the city.

The original estimates of cost were, for dredging, $65,540; for breakwater, $165,760.

The act of March 3, 1899, added to this project by authorizing an extension of the breakwater to the shore, thus requiring the ultimate construction of 10,200 feet of breakwater. The emergency river and harbor act of June 6, 1900, provided that the appropriation already made should be expended in building a shore spur 4,700 feet in length from a point 2,600 feet east of the prolongation of the present breakwater and parallel thereto. This again changed the project, adding greatly to the total length of breakwater to be constructed and largely to the total expense.

The total amount expended on this project and its modifications up to the close of the fiscal year ending June 30, 1908, not including outstanding liabilities, is $400,087.16, of which amount $204,822 has been applied to the maintenance of the improvement.

Under this project and its two modifications there have been constructed 7,454 feet of breakwater on the original line and 842 feet on the line fixed by the act of June 6, 1900.

Of the 7,454 feet on the original line 91 feet is detached and uncompleted work near shore and 7,363 feet is completed breakwater in one piece.

The pile, slab, and rock breakwater on the original line is in very poor condition, and has required large expenditures for maintenance.

The work of revetting this structure with riprap so as to form a permanent rubble-mound breakwater, with the old structure for a hearting, was begun in May, 1903, and has continued with more or less work each year up to the present date, under three successive contracts. Under each of these contracts the plant was small and the rate of progress rather slow, but the low prices obtained under competitive bids compensated in a measure for the greater length of time required. A diagram showing the method of reenforcing the breakwater may be seen in the Annual Report of the Chief of Engineers for 1905, page 1992.

On June 30, 1908, the total distance revetted was 5,282 feet, which is 72 per cent of the entire length of the present breakwater.

The work done gives a protected area of about 1,600 acres and affords safe anchorage and dockage for a distance of 3 miles along the city front.

The usefulness of the breakwater was in evidence when the northeast storm of September 2–3, 1905, caused considerable damage to the village of Washburn, across the bay from Ashland, breaking in 10 of the doors of the large flour shed of the Northwestern Railway Company and cutting away the embankment of the railroad approach, while the numerous docks along the Ashland Harbor front under the protection of the breakwater escaped injury. This storm seriously damaged the breakwater itself along the portions which had not been strengthened by the rock embankment.

Dredging by the Government in the years 1897, 1903, and 1907 constructed a channel which has a length of 5,760 feet and extends in front of the existing wharves of the city where the original depth of water was not already sufficient for navigation. This channel now has a width of 80 to 120 feet for a depth of 20 feet or more at mean low water and a somewhat greater width for an 18-foot depth. The width is not as great as it should be.

The dredgings from this channel have been deposited alongside the Government breakwater to form an earth embankment and lessen the amount of rock required for the revetment.

Easterly from the dredged channel the natural depth of the bay in front of the harbor line is a little more than 19 feet at mean low water and sufficient for the present needs of commerce.

The usual variation of level of the water surface is from about 0 to +1 foot, referred to mean low water.

The commerce of this port carried by vessels consists principally of iron ore and lumber exported, and coal, mineral oil, and general merchandise imported. (Note: With the commerce of Ashland are included the towns of Washburn and Bayfield, unless otherwise stated.)

The commerce has increased during the twenty years the harbor has been under improvement by the United States from 892 arrivals and clearances, with cargo tonnage of 1,400,000 tons (of 2,000 pounds), in 1887, to 2,234 arrivals and clearances, with cargo tonnage of 4,856,239 tons (of 2,000 pounds), valued at $23,856,242, in 1907. The total commerce from 1887 to 1907, inclusive, is estimated at 69,948,720 tons (of 2,000 pounds), valued at $508,885,924, exclusive of logs towed in rafts.

Effect of project on freight rates: The estimated saving in cost of transportation by water over that by rail is $1.82 per ton, almost $9,000,000 for the business of this port in 1907. (See also page 633 of this report.)

The protection to the commerce of Ashland alone afforded by Government improvements is fully stated in another part of this report.

It is estimated that the sum of $47,000, in addition to the balance on hand, can be profitably expended in the year ending June 30, 1910. Of this amount the sum of $15,000, together with the balance on hand, making a total of $25,000, would be expended in widening the Government channel in front of the wharves, and the sum of $32,000 for maintenance, including the completion of the revetment of the breakwater, after the termination of the present contract, on the present

plan to the end, the filling out of portions of the breakwater where settlements have occurred, and for the removal of shoals.

References: Map in Annual Report of the Chief of Engineers for 1903, page 1812. Lake Survey chart of the Apostle Islands, including Chequamegon Bay, catalogue No. Sf1. Lake Survey Bulletin No. 18, page 41. For reports on examinations and surveys, see Annual Report of Chief of Engineers for 1906, page 570, where references are given.

July 1, 1907, balance unexpended		$115,345.37
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$8,500.00	
For maintenance of improvement	42,432.53	
		50,932.53
July 1, 1908, balance unexpended		64,412.84
July 1, 1908, outstanding liabilities		1,787.65
July 1, 1908, balance available		62,625.19
July 1, 1908, amount covered by uncompleted contracts		52,100.00
Amount (estimated) required for completion of existing project		311,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		47,000.00

(See Appendix J J 5.)

6. *Harbor at Ontonagon, Mich.*—The entrance to Ontonagon River, which forms the harbor, had but 7 feet depth in 1867, at which time the project for securing 12 feet depth by building parallel piers on either side of the mouth, extending to the 18-foot curve of depth in Lake Superior, and dredging a channel between the piers, was adopted. Estimated cost, $363,770. The west pier was built to a length of 2,675 feet and the east pier to a length of 2,315 feet. This brought the outer end of the west pier very nearly to the 18-foot curve of depth, as proposed.

As far as new work is concerned the project has been completed since 1889, and since then expenditures have been only for keeping a 12-foot channel open by dredging and for the repairs to the piers.

The amount expended on this improvement up to the close of the fiscal year ending June 30, 1908, not including outstanding liabilities, is $377,296.24, of which sum $92,495 has been spent for maintenance of the improvement.

The history of this harbor shows that when completed and dredged in 1891 it had a somewhat narrow channel depth of 16 feet between the piers, but this gradually shoaled to 12 feet, and in 1894 dredging was done to the extent of 33,817 cubic yards to provide for 12-foot navigation. No further dredging was necessary until 1903, when 18,054 cubic yards was dredged to provide a channel 100 feet wide, with a least depth of 15 feet.

During the past four years the shoaling has been abnormal, and in addition to the last two appropriations of $3,000 and $5,000, respectively, made by Congress, three allotments, two of $5,000 each and one of $10,000, have been made from the emergency appropriations. The dredging done in the fiscal years 1905 and 1906 to give navigation the barest needs was more than all other dredging since

gress December 11, 1907, is published in House Document No. 325, Sixtieth Congress, first session.

The maximum draft that can be carried through the waterway at present is 20 feet at low water.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

During the navigation season of 1907 the commerce through this waterway amounted to [a] 1,293,683 short tons of freight, valued at [a] $51,217,580, and [a] 34,713 passengers.

There was also a local business between the [b] ports on the waterway, not included in the foregoing, the amount of which is not known.

Effect of project on freight rates: Based on the above commerce, the estimated saving of $1.82 per ton in freight rates by water over railroad rates amounts to one and one-third millions of dollars. This business would not be possible except for the improvements to this waterway, which the Government has either executed itself or paid for by purchase.

This waterway also serves a useful purpose as a harbor of refuge and is much used by vessels bound up or down, doing business at the head of the lake, particularly during the stormy season in the fall of the year. As many as 46 vessels have been tied up at one time at Lily Pond waiting for weather. By lessening the danger and risks of navigation in this manner, to whatever degree, makes this waterway to that extent a factor in the reduction of cost of transportation.

For reports on examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 574, where references are given; also House Document No. 325, Sixtieth Congress, first session.

July 1, 1907, balance unexpended	$14,889.82
June 30, 1908, amount expended during fiscal year for works of improvement	10,346.64
July 1, 1908, balance unexpended	4,543.18
July 1, 1908, outstanding liabilities	2,689.84
July 1, 1908, balance available	1,853.34

(See Appendix J J 7.)

8. Operating and care of waterway across Keweenaw Point, from Keweenaw Bay to Lake Superior, Michigan.—During the fiscal year ending June 30, 1908, the sum of $12,900 from the permanent indefinite appropriation of July 5, 1884, was expended in repairs to the breakwaters, in dredging, in superintendence and general operation of the canals, guarding against encroachments on the channels by private parties and corporations, on surveys and mapping of the waterway, and the collection of commercial statistics, etc.

An allotment of $14,000 from the same source for the same purpose has been made for the fiscal year ending June 30, 1909.

To June 30, 1908, $182,207.64 had been expended on this work.

[a] This commerce is the local commerce of the ports on the waterway only. The through commerce amounted to 1,154,358 tons, valued at $50,557,226. Heretofore the local and through commerce was combined, therefore no comparison is made of the commerce of 1907 with previous years.

[b] Houghton, Hancock, Dollar Bay, Lake Linden, Hubbell, and Chassell.

For further details see the report on this work by the district officer.

(See Appendix J J 7.)

9. Harbor at Marquette, Mich.—This harbor, which had a natural depth of 18 feet or more, afforded no protection to vessels from easterly or northeasterly storms, and projects were approved in 1867 and 1887 for the construction of a breakwater composed of cribs filled with rock and projecting from the shore into the bay a distance of 3,000 feet. This breakwater was finished in 1894 practically as projected, but since its commencement extensive repairs have been made to the superstructure.

The amount expended up to the commencement of operations upon the new project was $469,732.44.

A project for a concrete superstructure was approved February 27, 1890. Its estimated cost was $232,936.71.

Work on this concrete superstructure was begun in the spring of 1895, and it is now built to a length of 2,920 feet, which is 97 per cent of the entire length. It is 100 feet short of the end of the old breakwater, and all that remains to complete the existing project is to build a pierhead and connect it with the finished work.

A preliminary examination and a survey of Marquette Harbor and vicinity, "with a view to ascertaining whether further harbor of refuge facilities are needed, and if so, at what point," authorized by the river and harbor act approved June 13, 1902, were made hy tbe district officers, who express the opinion that greater refuge facilities are needed in this vicinity; that Marquette Harbor is the best place for such improvement, and that the additional shelter should be secured by extending the present breakwater for a distance of 1,500 feet at an estimated cost of $303,000. The reports on this subject were transmitted to Congress by the Secretary of War December 16, 1903, and printed in House Document No. 161, Fifty-eighth Congress, second session. They are also printed in the Annual Report of the Chief of Engineers for 1904, Appendix I I, page 2786. The document is accompanied by a map of the harbor.

If provision be made by Congress for this extension, no pierhead will be required at the present end of the breakwater, but before beginning the extension the regular form of concrete superstructure would have to be continued over the gap of 100 feet which now remains. This would cost $6,000, and the money could be taken from the funds now held in reserve for further improvement ($21,391) awaiting the decision of Congress on this matter.

The amount expended on the new project up to the close of the fiscal year ending June 30, 1908, not including outstanding liabilities, was $199,550.07, of which $19,208.05 was spent for maintenance.

The expenditure during the year was for incidental expenses and contingencies.

The work done has resulted in the protection of the ore, coal, lumber, and commercial docks from storms, and has shown the efficiency of the concrete breakwater.

Between the breakwater and the ore docks to the west there is generally from 20 to 30 feet of water, except at the northerly 400 feet of the harbor, where the depth at low-water datum is only 14 to 18 feet. This shallow water makes it difficult for vessels doing busi-

ness at the ore docks at the north end of the harbor, besides somewhat restricting the area available for harbor of refuge purposes, and at least a portion of this area should be dredged to a clear depth of 21 feet at low-water datum.

For the maintenance of the breakwater the sum of $10,000 should be appropriated biennially.

The usual variation of water level extends from 0 to + 1 foot above low-water datum.

The vessel commerce of this port has increased from 780 arrivals and clearances during the fiscal year ending June 30, 1872, with a registered tonnage of 370,000 tons, to 2,064 arrivals and clearances in 1896, carrying 1,832,061 short tons of freight, and 1,198 arrivals and clearances in 1907, carrying 3,838,981 short tons, valued at $14,228,748. The total commerce from 1867 to 1907, inclusive, is estimated at 41,169,350 short tons, valued at $179,894,513. The foregoing includes Marquette Bay.

Effect of project on freight rates: Taking the estimated saving in cost of transportation by water over that by rail as $1.82 per ton, as on page 633 of this report, and the amount of vessel freight in 1907 as 1,934,738 tons (exclusive of the business done at Presque Isle), makes a total saving of over $3,500,000 for the one year. This may be said to have been effected by Government improvements, as lake commerce could not otherwise be transacted at that locality.

It is proposed to expend the appropriation recommended and the available balance (except $21,391 held in reserve for further improvement) for maintenance.

For reports of examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 576, where references are given.

July 1, 1907, balance unexpended	$29,714.23
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,408.05
July 1, 1908, balance unexpended	28,306.18
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix J J 8.)

10. Harbor of refuge, Marquette Bay, Michigan.—Marquette Bay, also known as Presque Isle Harbor, is a small bay within the city limits of Marquette, north of Marquette proper, and distant 1½ miles therefrom.

Before improvement the locality was fully exposed to storms from the east and northeast, and comparatively little shipping was done.

A resolution of Congress, approved March 20, 1896, directed the Secretary of War to make a survey and submit an estimate for a breakwater in this bay. The results of this survey, with estimates amounting to $20,000 for breakwater 500 feet long and $50,000 for construction of one 1,000 feet long, are published in House Document No. 318, Fifty-fourth Congress, first session.

The project adopted by the act of June 3, 1896, is to build a breakwater 1,000 feet in length off Presque Isle Point.

This breakwater was completed to its full length in July, 1900.

The act of Congress approved June 13, 1902, provided that a portion of the appropriation for Marquette Harbor "not exceeding seven thousand five hundred dollars may be expended in connecting the Presque Isle breakwater with the shore."

Under this provision the gap between the breakwater and shore was closed, in the fall of 1902, by a timber pier 216 feet long and 100 linear feet of shore revetment constructed.

No additional work is proposed except for maintenance.

The total amount expended on the project up to the close of the fiscal year ending June 30, 1908, not including outstanding liabilities, was $57,597.34, of which $2,541 was expended for maintenance.

The work done has enabled vessels to lie in safety at the ore pier and other docks in the vicinity, and shipping has increased greatly.

This harbor is largely used for commercial purposes, but to little or no extent as a harbor of refuge.

Vessels drawing 19 feet can reach the ore pier at mean low water.

The usual variation of water level extends from 0 to +1 foot above low-water datum.

The lake commerce of this port has increased from 1,110 arrivals and departures, with 1,095,243 tons of freight, in 1897, to 662 arrivals and departures, with 1,904,243 short tons, valued at $5,319,697, in 1907. The total commerce from 1897 to 1907, inclusive, is estimated at 17,195,088 short tons, valued at $45,440,094.

Effect of project on freight rates: The saving in cost of transportation by water of 1907 freight over the cost by rail, at the estimated figure of $1.82 per ton, as on page 633 of this report, amounts to $3,465,700. This was made practicable by the Government breakwater at this locality. This harbor, as already stated, is not used for purposes of refuge, and it may be questioned whether its freight business could not have been transacted at Marquette, only 3 miles distant, where the Government had already constructed a harbor.

It is proposed to expend the available balance, together with the appropriation recommended, on repairs to the breakwater.

For reference to reports on survey, see Annual Report of the Chief of Engineers for 1896, page 307.

July 1, 1907, balance unexpended	$902.66
July 1, 1908, balance unexpended	902.66
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix J J 9.)

11. Harbor of refuge at Grand Marais, Mich.—Originally the entrance to this harbor was obstructed by a bar having but 9 feet depth of water upon it. The project for its improvement, adopted August 5, 1881, and modified December 21, 1894, has for its object a deep and safe channel into the harbor, making it a harbor of refuge. This object is to be attained by building parallel piers 500 feet apart, projecting into the lake to a depth of 22 feet, and dredging out an 18-foot channel between them, connecting the deep water of the lake with that of the harbor, and by closing up the natural entrance, 5,770 feet in width, by a solid pile dike, driven with a slope toward

the waves and strongly braced. The proposed length of each pier was 1,800 feet. The estimated cost of the entire project was $484,000. The west pier has now reached a length of 1,912 feet, the east pier 1,545 feet, and the pile dike is completed.

This dike was built in 1895–1897 to close the natural entrance, to protect the harbor from storms, and prevent the movement of sand into the harbor. The expected formation of a sand beach along the line of the dike is partially realized, but much of the dike is still exposed to the heavy seas and to damage by ice.

The amount expended on the project up to the close of the fiscal year ending June 30, 1908, not including outstanding liabilities, was $448,832.36, of which $92,947.07 was expended for maintenance.

About 3,600 feet of the pile dike was repaired and strengthened between September 1, 1904, and August 6, 1906, under two contracts, at a total cost (including administration) of nearly $54,000.

It is hoped that no further work than this will be necessary on the dike, but it is possible that the riprap will settle into the sand bottom by the action of waves and require additional rock.

The last dredging was done in 1904 and gave an average depth of 18½ feet at low-water datum and a least depth of 16 feet (where some lumps were left by the dredge) for a width of 180 feet to 190 feet.

Some shoaling in the entrance channel has occurred since this dredging was done, soundings taken in June, 1908, showing a least depth of 12.7 feet in the central width of 250 feet through the entrance and a least depth of 14 feet on the center line.

Some dredging between the piers will be done during the next few months to remove these shoals, amounting to approximately $16,000.

The usual variation of water level extends from 0 to +1 foot above low-water datum.

In front of the entrance to the harbor the 22-foot curve of depth has advanced lakeward between 400 and 500 feet since the project for improvement was adopted, and this fact will entail some additional expense for pier extension to deep water. This would now require an addition of 360 feet to the west pier and 704 feet to the east pier. This would bring the total cost of these extensions up to $127,680—about $44,512 more than the original estimate. It is hoped, however, that the original estimate will finish the west pier and build all that is necessary of the east pier. The west pier is now advanced 344 feet farther into the lake than the east pier.

The sand movement in front of the entrance is generally from the west toward the east, and it is important that the west pier be extended to deep water soon, in order to shut off the encroachment of sand upon the channel from that direction. The extension of the east pier should be built after the completion of the west pier, and it is quite possible that its full extension will not be necessary.

The commerce of this port has increased from 1,910 tons in 1887 to 656 arrivals and clearances, with 90,497 tons of freight, valued at $691,650, in 1896, and 1,769 arrivals and clearances in 1907, with 54,525 short tons, valued at $2,539,780.

The total commerce from 1880 to 1907, inclusive, is estimated at 1,390,784 short tons, valued at $23,037,646.

Effect of project on freight rates: Estimated saving by water transportation as against rail, $1.82 per ton, amounting to $99,200 for the lake commerce of 1907. (See p. 633 of this report.) With

the original condition of the harbor this shipping could not have been carried on, and the above-mentioned saving in cost of transportation is a result of the project for improvement.

The available balance, together with the sum recommended, it is proposed to expend in extending the west pier, and in repairs to piers and dike, and in dredging between the piers.

For reports on examinations and surveys, see Annual Report of the Chief of Engineers for 1906, page 579, where references are given.

July 1, 1907, balance unexpended	$37,646.03
June 30, 1908, amount expended during fiscal year for maintenance of improvement	755.07
July 1, 1908, balance unexpended	36,890.96
Amount (estimated) required for completion of existing project	45,401.68
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	85,400.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix J J 10.)

12. Removing sunken vessels or craft obstructing or endangering navigation.—The steamer *Alex Nimick*, wrecked September 21, 1907, on the south shore of Lake Superior, proving an obstruction to navigation its removal was authorized.

Contract has been entered into, but no work has yet been done.

(See Appendix J J 11.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination, with plan and estimate of cost of improvement, of Keweenaw Canal, Michigan, with a view to the construction of a harbor of refuge at its eastern end.—Reports dated August 22 and October 30, 1907, respectively, are printed in House Document No. 325, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $210,000 is presented.

2. Preliminary examination of Ontonagon Harbor, Michigan, with a view to changing the course of Ontonagon River.—Report dated September 14, 1907, is printed in House Document No. 444, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

3. Preliminary examination of Lake Superior, with a view to locating harbors of refuge on the north shore.—Report dated October 17, 1907, is printed in House Document No. 450, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States in the manner proposed.

4. Preliminary examination of Munising Harbor, Michigan.—Report dated September 21, 1907, is printed in House Document No. 479, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

5. Preliminary examination, with plan and estimate of cost of improvement, of Grand Marais Harbor, Minnesota, with a view to rebuilding the piers at the entrance and enlarging the basin.—Reports dated October 16 and November 23, 1907, and January 4, 1908, are printed in House Document No. 939, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $70,416 is presented.

EXAMINATION AND SURVEY OF DULUTH HARBOR, MINNESOTA, MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Report dated June 20, 1907, by a Board of Engineers, of an examination and survey of *Duluth Harbor, Minnesota*, required by the river and harbor act of March 2, 1907, was duly submitted and was reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law. The report was transmitted to Congress and printed in House Document No. 221, Sixtieth Congress, first session. A plan of improvement at an estimated cost of $550,800 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE MILWAUKEE, WISCONSIN, DISTRICT.

This district was in the charge of Maj. W. V. Judson, Corps of Engineers, having under his immediate orders First Lieut. Douglas MacArthur, Corps of Engineers, since August 10, 1907. Division engineer, Col. W. H. Bixby, Corps of Engineers, to February 15, 1908, and Lieut. Col. W. L. Fisk, Corps of Engineers, since that date.

1. Manistique Harbor, Michigan.—The original depth at the mouth of the Manistique River was 8 feet. By private enterprise 3,000 linear feet of slab piers had been built and a channel dredged to a depth of 11 feet before any appropriation was made by the Government.

The original project, adopted in 1880, provided for increasing the depth of the channel to 13 feet below datum for a width of 150 feet by dredging. The amount expended on this project was $3,955.05.

The present project was adopted by the river and harbor act of March 3, 1905, and provides for pier construction, breakwater extension, and dredging to a depth of 19 feet below datum; estimated cost $270,000 (see Annual Report of the Chief of Engineers for 1905, p. 525).

In accordance with a provision in the river and harbor act of March 2, 1907, a modification of this project was approved by the Secretary of War, April 3, 1908. The modification consists mainly in swinging the inner end of the proposed west pier to the westward, thereby providing a stilling basin, and in extending the east breakwater about 90 feet farther westward than at first provided; estimated cost $338,462.

Neither of the foregoing estimates includes the acquisition of land and existing structures required in connection with the proposed work, which have been transferred to the United States without expense.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1908, was $5,228.52, none of which was applied to maintenance.

The expenditures during the fiscal year have been for general supervision. No result in the way of increased depth and width has been obtained.

A dam across the Manistique River, located about 1 mile from the mouth of the harbor, constitutes the head of navigation.

It is proposed to expend the available balance in the construction of revetment at mouth of Manistique River, as provided by the project, and in dredging. It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, to the completion of the project. The additional work is necessary to make the improvement available.

The maximum draft that could be carried June 30, 1908, was about 15 feet. The usual mean annual variation of level of water surface is about 1 foot.

The commerce affected by the project is in lumber, coal, and general merchandise. Car ferries call at this harbor during the entire year. The volume of commerce which will be benefited is considerable.

It is believed that the project will have a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore, both locally and for transshipment.

For references to more extended information, and for report on examination and survey, see Annual Report for 1904, Part 3, page 2869.

Commercial statistics for 1907: Arrivals of vessels, 86; shipments and receipts, 104,426 tons.

July 1, 1907, balance unexpended	$47,590.81
June 30, 1908, amount expended during fiscal year for works of improvement	774.38
July 1, 1908, balance unexpended	46,816.43
Amount (estimated) required for completion of existing project	288,462.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	288,462.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix K K 1.)

2. Gladstone Harbor, Michigan.—The harbor of Gladstone is a natural one, and the main channel is from 24 to 42 feet in depth. The portion of this harbor under improvement was obstructed by shoals.

The original project, which is the existing project, was adopted by act of March 3, 1905, and provides for dredging to a depth of 21 feet below datum of so much of the harbor as lies outside of a line drawn perpendicular to the axis of the ore dock through its outer end. Estimated cost, $14,000. The amount expended on the work up to the close of the fiscal year ending June 30, 1908, was $7,527.76, of which $247.17 was applied to maintenance.

There have been no expenditures during the fiscal year.

The approved project was completed in 1905; since then the expenditures have been for maintenance.

The maximum draft which could be carried June 30, 1908, was about 21 feet. The usual mean annual variation of level of water surface is about 1 foot.

The commerce affected by the project is mostly coal, grain, flour, and general merchandise, and is general in character. The volume of commerce is large.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore, both locally and for transshipment.

For report on examination and survey, see Annual Report for 1904, Part 3, page 2861.

Commercial statistics for 1907: Arrivals of vessels, 256; shipments and receipts, 549,270 tons.

July 1, 1907, balance unexpended	$6,472.24
July 1, 1908, balance unexpended	6,472.24

(See Appendix K K 2.)

3. Menominee Harbor and River, Michigan and Wisconsin.—Prior to act of June 13, 1902, the harbor and river constituted two works. By this act they were consolidated.

(*a*) *Harbor.*—Original depth of channel, about 5 feet; width, 200 feet. The original project, adopted in 1871, provided for two parallel piers, 400 feet apart, extending to the 16-foot contour in Green Bay, and for a channel 15 feet deep between them, modified as follows: 1874, extending piers to 17-foot contour; 1890, increasing depth to 17 feet; 1899, increasing depth to 20 feet. Amount expended on original and modified projects, $234,344.77.

(*b*) *River.*—Original navigable depth, 5 feet. The original project, adopted in 1890, provided for a channel 200 feet wide and 17 feet deep, modified as follows: 1892, width at upper end reduced to 100 feet; 1896, formation of a turning basin 250 feet wide, 600 feet long, 17 feet deep at upper end of channel, and extending channel 425 feet for a width of 75 feet. Amount expended on original and modified projects, $114,414.15.

(*c*) *Harbor and river.*—The existing project, adopted by act of Congress approved June 13, 1902, provides for increasing the depth to 20 feet, at an estimated cost of $60,000.

Under a provision of the act of March 3, 1905, the existing project was modified by omitting therefrom the improvement of all that portion of the Menominee River above and to the westward of Ogden Street Bridge.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1908, was $53,230.54, of which amount $14,978.85 was applied for maintenance. Of this amount $3,372.14 was derived from miscellaneous sources.

The existing project, as modified, was completed in 1903. Since then the expenditures have been for maintenance.

The expenditures during the fiscal year have been for general supervision and for repairs and purchase of plant.

The maximum draft that could be carried June 30, 1908, over the shoalest part of the locality under improvement was about 18 feet. The mean annual variation of level of water surface is about 1 foot.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, in repairs of piers and dredging for restoration of channel.

The Menominee River is navigable for a distance of about 2 miles from its mouth.

The volume of commerce, while large, is not increasing.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and lumber, both locally and for transshipment.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 519, and page 669 of this report.

Commercial statistics for 1907.—Arrivals of vessels, 208; shipments and receipts, 257,014 net tons.

July 1, 1907, balance unexpended	$7,754.10
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,809.39
July 1, 1908, balance unexpended	5,944.71
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	20,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix K K 3.)

4. Oconto Harbor, Wisconsin.—The original depth at the mouth of the river, about 3 feet, was increased by private enterprise to 4 feet before work was begun by the United States.

The original project, adopted in 1882, provided for extending the parallel slab piers built by the city of Oconto to the 11-foot contour in Green Bay and for a channel 100 feet wide and 9 feet deep extending up the Oconto River a distance of about 2 miles, at an estimated cost of $150,000; modified in 1897 by abandoning the upper 3,800 feet of the channel; estimated cost of modified project, $115,610.

The amount expended to June 30, 1908, was $92,579.65, of which $8,010.18 was applied to maintenance.

There have been no expenditures during the fiscal year.

The 9-foot channel was practically completed in 1899.

The maximum draft that could be carried June 30, 1902, was about 7.5 feet. No soundings have been taken since then. For 1,000 feet above the westerly end of the Government improvement the Oconto River has a navigable depth of about 3 feet.

Mean annual variation in level of water surface is about 1 foot.

The commerce benefited by the improvement is of a purely local character and small in volume.

It is believed that the project has no material effect in controlling freight rates. A 9-foot harbor on Lake Michigan at this time would be without value to commerce.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Reports for 1904, page 520, and 1906, page 599.

July 1, 1907, balance unexpended	$3,420.35
July 1, 1908, balance unexpended	3,420.35

(See Appendix K K 4.)

5. Green Bay Harbor, Wisconsin.—This work consists of two improved channels—first, from the mouth of Fox River northerly to the 21-foot contour in Green Bay; second, Fox River below Depere to the southerly limits of the city of Green Bay. The intervening pool in Fox River, connecting these channels, has a natural depth of from 25 to 40 feet and requires no improvement. The outer channel was originally circuitous and narrow, with an available depth of 11 feet. The original navigable depth of the inner channel was also 11 feet.

The original project for outer channel, adopted in 1866, provided for dredging a channel 200 feet wide, 13 feet deep, and 8,800 feet long, and for revetting about 650 feet of same at Grassy Island, modified as follows: 1872, straightening channel and increasing depth to 14 feet; 1874, depth 15 feet, length 11,600 feet; 1892, depth 17 feet, length 16,500 feet; 1897, increasing width at entrance to 500 feet.

The original project for inner channel, adopted in 1892, provided for dredging a channel 150 feet wide and 13 feet deep, modified as follows: 1896, increasing depth to 17 feet.

These channels were completed by the expenditure of $405,945.18.

The existing project, adopted by Congress by act approved June 13, 1902, provides for increasing the depth of the outer channel to 20 feet, at an estimated cost of $105,600. It also provides for maintenance of existing works.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1908, was $120,497.39, of which amount $18,150.67 was applied to maintenance.

The expenditures during the fiscal year have been for dredging for restoration of outer channel and for general supervision.

The approved project was completed in 1903. Since then all expenditures have been for maintenance.

It is proposed to apply the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, in maintenance of channels and existing works.

The maximum draft that could be carried June 30, 1908, was about 19 feet in the outer channel and 13 feet in the inner channel.

The mean annual variation in level of water surface is about 1 foot.

Connecting with the upper end of the inner channel at Depere, Wis., Fox River is navigable by canals and slack-water navigation to Portage, Wis., a distance of 156 miles.

The commerce of Green Bay is large and of a general character.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and lumber, both locally and for transshipment.

For references to more extended information, maps and reports on examinations and surveys, see Annual Report for 1904, page 521.

Commercial statistics for 1907.—Arrivals of vessels, 1,494; shipments and receipts, 838,384 tons.

July 1, 1907, balance unexpended	$8,594.90
June 30, 1908, amount expended during fiscal year, for maintenance of improvement	5,906.58
July 1, 1908, balance unexpended	2,688.32
July 1, 1908, outstanding liabilities	810.00
July 1, 1908, balance available	1,878.32

Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	$40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix K K 5.)

6. Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin, and harbor of refuge connected therewith.—Prior to act of June 13, 1902, the canal and harbor constituted two works. By this act they were consolidated.

(*a*) *Canal.*—In its natural condition Lake Michigan was separated from Sturgeon Bay, an arm of Green Bay, by a neck of land about 1⅜ miles wide, having a maximum elevation above the lake level of about 28 feet. The Sturgeon Bay and Lake Michigan Ship Canal and Harbor Company, from 1872 to 1881, constructed across this neck a canal, without locks or gates, 7,200 feet long, 100 feet wide at water surface, and 14 feet deep, and in continuation of the canal dredged a channel in Sturgeon Bay 6,100 feet long, of about same dimensions as the canal. Of the 14,000 linear feet of canal banks, 8,437 feet was provided with pile revetments. The United States assumed possession of the canal April 25, 1893.

The original project, adopted in 1894, provided for building 6,000 linear feet of revetment, width between new revetments to be 160 feet, for building 2,000 linear feet of fender piling, and for a channel 15 feet deep; modified as follows: 1896, provided for a width of 250 feet between revetments for the westerly 1,000 feet of the canal, and for increasing width between revetments, whenever rebuilt, to 160 feet. The original project as modified was completed during the fiscal year ending June 30, 1903.

(*b*) *Harbor.*—Before the construction of this harbor was undertaken the Lake Michigan entrance to the Sturgeon Bay and Lake Michigan Ship Canal was entirely unprotected from storms from northeast to southwest.

The original project, adopted in 1873, provided for the construction of converging piers 850 feet apart at the shore line, and 250 feet apart at outer end, inclosing an area of about 10 acres, which was to be dredged to the requirements of navigation at that time; modified as follows: 1879, provided for sheet piling the pile piers; 1880, provided for extending each pier 150 feet by detached cribs, thereby increasing width of entrance to 335 feet, and dredging to a depth of 17 feet. The original project as modified was completed in 1884.

The amount expended on the foregoing projects is $349,119.26.

(*c*) *Canal and harbor.*—The existing project adopted by act of Congress approved June 13, 1902, provides for maintenance and for increasing the depth of channel to 21 feet from Lake Michigan to Sturgeon Bay; estimated cost, $222,000. The river and harbor act approved March 2, 1907, authorizes dredging in the vicinity of Hills Point.

The amount expended on existing project up to the close of the fiscal year ending June 30, 1908, is $251,765.82, of which $19,115.28 was applied to maintenance. Of this amount $11,839.75 was derived from miscellaneous sources.

The expenditures during the fiscal year have been principally for dredging in the vicinity of Hills Point. About 500 feet of channel in the vicinity of the bridge has also been dredged to full project depth. These expenditures have resulted in the completion of existing project with the exception of a small amount of dredging near Hills Point.

The maximum draft that could be carried June 30, 1908, between Lake Michigan and Green Bay was about 20 feet.

Mean annual variation in level of water surface is about 1 foot.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, and lumber. It is impracticable to estimate the amount of reduction in rates thereby effected.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 523.

Commercial statistics for 1907.—Number of vessels passing through canal, 2,328; tonnage, 1,503,820; estimated value of cargoes, $21,011,696; number of vessels seeking shelter, 133; tonnage, 52,266; number of passengers passing through canal, 11,913; increase in value of cargo in 1907 as compared with 1906, $670,932.60.

July 1, 1907, balance unexpended		$58,114.26
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$23,514.52	
For maintenance of improvement	1,022.42	
		24,536.94
July 1, 1908, balance unexpended		33,577.32
July 1, 1908, outstanding liabilities		1,482.40
July 1, 1908, balance available		32,094.92

(See Appendix K K 6.)

7. *Operating and care of Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.*—Under an allotment from the indefinite appropriation of July 5, 1884, for operating and care of canals and other works of navigation, there was expended during the fiscal year ending June 30, 1908, $30,077.13.

The amount expended to June 30, 1908, is $281,720.28, including $1,483.88 miscellaneous receipts.

Extensive repairs were made to the entrance piers and to the revetments. Minor repairs were also made to the buildings and plant pertaining to the canal. The premises in the vicinity of the office and watchhouses were graded and otherwise improved, and the canal operated and cared for in accordance with the approved project.

Navigation through the canal opened April 1, 1907, closed by ice December 27, 1907, and resumed April 11, 1908.

For commercial statistics, see report upon improvement of Sturgeon Bay and Lake Michigan Ship Canal and harbor of refuge connected therewith.

(See Appendix K K 7.)

8. *Algoma Harbor, Wisconsin.*—Previous to the improvement of this harbor the depth of water at the mouth of the Ahnapee (or Wolf) River was only 3 feet and the present harbor was not available for purposes of commerce.

The original project adopted in 1875 provided for the formation of a small artificial harbor, connected with the lake by a channel 100 feet wide and 13 feet deep, by pier construction, dredging, and rock removal, modified as follows: 1884, width of entrance increased to 200 feet by offset in each pier, main and detached piers to be connected by guide piling; March 3, 1899, provided for extending the 13-foot channel, for a width of 50 feet, a distance of 800 feet by rock removal and dredging, at an estimated cost of $19,266.

The amount expended on this project and its modifications to June 30, 1908, is $201,681.46, of which $8,687.96 was for maintenance.

The existing project, adopted by Congress by act approved March 2, 1907, provides for the construction of an outer harbor, with a depth of 16 feet of water; estimated cost, $140,000, all of which has been appropriated.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1908, was $28,923.31, of which $7,538.54 was applied to maintenance.

No result in the way of increased depth has yet been obtained, but it is expected that the project will be completed during the season of 1908.

The maximum draft that could be carried to the Goodrich dock June 30, 1908, was about 12 feet. The mean annual variation in level of water surface is about 1 foot.

Ahnapee River is navigable for a distance of about 2 miles from its mouth for crafts drawing 4 feet, but there are no vessels plying on it.

The volume of commerce benefited is small and of a local character. It is believed that the project will have an excellent effect in controlling freight rates, but that this effect will be local and consequently limited in amount.

For reference to more extended information, maps, and report on examination and survey, see Annual Report for 1904, page 524.

Commercial statistics for 1907.—Arrivals of vessels, 315; shipments and receipts, 159,559 tons.

July 1, 1907, balance unexpended		$46,604.29
Amount appropriated by sundry civil act approved May 27, 1908		100,000.00
		146,604.29
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$21,384.77	
For maintenance of improvement	6,604.29	
		27,989.06
July 1, 1908, balance unexpended		118,615.23
July 1, 1908, outstanding liabilities		12,288.62
July 1, 1908, balance available		106,326.61
July 1, 1908, amount covered by uncompleted contracts		18,860.25

(See Appendix K K 8.)

9. Kewaunee Harbor, Wisconsin.—The original entrance to the Kewaunee River was not more than 20 feet wide, with a depth of about 3 feet at its shoalest point, and was obstructed by submerged bowlders. The present harbor was therefore not available for purposes of commerce.

The original project for its improvement adopted in 1881, which is the existing project, provided for an artificial entrance channel 15 feet deep, located about 2,000 feet south of the river mouth, protected by two parallel piers 200 feet apart, and extending from the shore to the 19-foot contour in the lake. Estimated cost, $200,000. The project was completed in 1898 at a cost of about $150,000.

The amount expended up to June 30, 1908, was $173,222.25, of which amount $23,222.25 was for maintenance. Of this amount, $417.44 was derived from miscellaneous sources.

The expenditures during the fiscal year have been for maintenance and general supervision.

It is proposed to expend the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, in repairs to piers and dredging for maintenance of channel.

The maximum draft that could be carried June 30, 1908, was about 15 feet. The mean annual variation in level of water surface is about 1 foot.

Connecting with the westerly end of the improved channel Kewaunee River has a navigable depth of 4 feet for a distance of about 6½ miles, but there is no regular commerce on the river.

The additional work proposed is for maintenance of piers and channel.

The volume of commerce is quite large and is of a general character. A line of car-ferry steamers calls at this harbor. The value of the water-borne commerce is stated by the mayor of Kewaunee to be as follows: Shipments, $5,469,995; receipts, $4,503,085; total, $9,973,080. The reliability of these figures is uncertain.

It is believed that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, etc., both locally and for transshipment. It is impracticable to estimate the amount of reduction in rates thereby effected.

For references to more extended information, maps, and reports on examination and survey, see Annual Report for 1904, page 525, and page 670 of this report.

Commercial statistics for 1907.—Arrivals of vessels, 401; shipments and receipts, 107,989 tons.

July 1, 1907, balance unexpended	$6,466.47
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,471.28
July 1, 1908, balance unexpended	4,995.19
July 1, 1908, outstanding liabilities	125.00
July 1, 1908, balance available	4,870.19
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix K K 9.)

10. Two Rivers Harbor, Wisconsin.—The original depth of the entrance to Twin rivers was from 3 to 4 feet and the present harbor was not available for purposes of commerce.

The original project adopted March 3, 1871, provided for the formation of a channel of navigable width and 13 feet deep, connecting Twin rivers with Lake Michigan by building parallel piers extending to the 19-foot contour and dredging between them, at an estimated cost of $265,588.80, modified in 1897, by terminating the piers at the 14-foot contour.

The total amount expended on original and modified project was $247,613.35.

The existing project, adopted March 2, 1907, is a modification of plan "A," printed in House Document No. 730, Fifty-ninth Congress, first session, and provides for increasing the depth of channel to 16 feet and for the construction of a stilling basin on the north side of harbor. The sum of $90,000 was appropriated for the purpose.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1908, was $16,421.49, of which $8,642.98 was applied to maintenance. No result in the way of increased depth has yet been obtained, but it is expected that the project will be completed during the season of 1908.

The expenditures during the fiscal year have been principally for timber to be used in building new pile pier and in repairing existing piers.

It is proposed to expend the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, in maintenance of channel and existing works.

The maximum draft that could be carried June 30, 1908, was about 12 feet. The mean annual variation in level of water surface is about 1 foot.

East and West Twin rivers have a navigable depth of 7 feet for a distance of about 3 miles and 7 miles, respectively, from the harbor piers. There is no regular commerce on these rivers. For many years they have been used by rowboats and for floating saw logs.

The volume of commerce of this harbor is small and of a local character. Its value is not known.

It is believed that the project has a small effect in controlling freight rates on coal for local consumption, but the amount of reduction in rates is unknown.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Reports for 1904, page 526, and for 1906, pages 599 and 645.

Commercial statistics for 1907.—Arrivals of vessels, 266; receipts, 63,580 net tons.

July 1, 1907, balance unexpended		$88,956.36
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$5,248.22	
For maintenance of improvement	8,642.98	
		13,891.20
July 1, 1908, balance unexpended		75,065.16
July 1, 1908, outstanding liabilities		7,127.37
July 1, 1908, balance available		67,937.79

July 1, 1908, amount covered by uncompleted contracts	$43,680.50
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix K K 10.)

11. Manitowoc Harbor, Wisconsin.—The original depth of water at the mouth of the Manitowoc River was about 4 feet at the shoalest point, and the existing harbor was not available for purposes of commerce.

The original project, adopted in 1854, provided for building parallel piers 220 feet apart and dredging between them to obtain a channel 12 feet in depth connecting Manitowoc River with Lake Michigan, modified as follows: 1881, provided for extending piers to 19½-foot contour and increasing depth to 19 feet at entrance and 15 feet at the shore line; 1890, provided for an exterior breakwater 400 feet long, 24 feet wide; 1896, provided for increasing depth of channel to 20 feet and extending south pier 500 feet; 1902, provided for extending the breakwater 400 feet.

The original project as subsequently modified was completed in 1903. The total amount expended thereon, including maintenance up to the time of adoption of present projects, is $454,666.79.

The existing project, adopted by Congress March 2, 1907, provides for maintenance of 20-foot channel and for the reconstruction of the harbor by the removal of outer 500 feet of existing breakwater and nearly all of the old parallel piers and by construction of new breakwaters and piers in accordance with report submitted in House Document No. 62, Fifty-ninth Congress, first session, as modified by Board of Engineers for Rivers and Harbors; estimated cost, $376,000, of which $5,500 is yet to be appropriated under continuing-contract authorization.

The amount expended under the existing project up to the close of the fiscal year ending June 30, 1908, was $148,509.49, of which $145,333.12 was for maintenance.

The expenditures during the fiscal year have been principally for breakwater construction. The northerly breakwater, with the exception of the rubble mound, is completed. Work on the southerly breakwater is in progress. It is expected to complete the entire project, with the exception of the rubble mounds, during the season of 1908.

The maximum draft that could be carried June 30, 1908, was about 20 feet. The usual mean annual variation of level of water surface is about 1 foot.

Connecting with the western end of the Government improvement, Manitowoc River is navigable for a distance of about 1.8 miles.

The volume of commerce is very large and of a general character. Two lines of car-ferry steamers call at this harbor daily throughout the entire year.

The city and one of the terminal railroads have recently begun extensive improvements of the inner harbor.

It is believed that the project has a very material effect in controlling freight rates, both locally and for transshipment.

For references to more extended information, maps, and reports on examinations and surveys see Annual Reports for 1904, page 526, and 1906, page 645.

Commercial statistics for 1907.—Arrivals of vessels, 1,736; shipments and receipts, 2,753,598 net tons.

July 1, 1907, balance unexpended	$200,540.73
Amount appropriated by sundry civil act approved May 27, 1908	270,500.00
	471,040.73
June 30, 1908, amount expended during fiscal year for maintenance of improvement	144,904.29
July 1, 1908, balance unexpended	326,136.44
July 1, 1908, outstanding liabilities	13,751.49
July 1, 1908, balance available	312,384.95
July 1, 1908, amount covered by uncompleted contracts	164,330.07
Amount (estimated) required for completion of existing project	5,500.00

(See Appendix K K 11.)

12. Sheboygan Harbor, Wisconsin.—The depth of water over the bar at the mouth of the Sheboygan River originally did not exceed 7 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1866, provided for extending the piers built by the city and county of Sheboygan to the 13-foot contour and dredging between them to a depth of 13 feet; modified as follows: 1873, for a deeper channel and pier extension; 1881, for extending piers to 21-foot contour and a depth of 19 feet at entrance, diminishing to 15 feet at shore line; 1894, for increasing width between piers and for a channel 19 feet deep; 1899, for a breakwater 700 feet long; 1902, for extending both piers and increasing depth of channel to 21 feet.

The original project as modified was completed in 1904 with the exception of 100 feet of breakwater. The total amount expended thereon, including maintenance up to the time of adoption of present project, is $575,099.44.

The existing project, adopted by Congress March 2, 1907, provides for maintenance of 21-foot channel and works incident thereto, for extension of north breakwater, for a south breakwater, and for subsequent necessary extensions to each breakwater in general accordance with type plan as set forth in report submitted in House Document No. 62, Fifty-ninth Congress, first session.

An estimate of the cost of a part of this project, amounting to $253,000, was submitted December 13, 1906, and published in River and Harbor Committee Document No. 3, Fifty-ninth Congress, second session. The Board of Engineers for Rivers and Harbors in its report on this project, published in the same committee document, stated that it was the belief of the Board that the proposed plan "should be held in abeyance until the completion of the proposed improvements at Ludington and Manitowoc, and that the adoption of a new plan for the improvement of any of these other harbors" (including Sheboygan) "should be postponed until the efficiency of the work at these two harbors is demonstrated."

If, however, it should be decided not to hold the proposed plan in abeyance, it is believed that the work of improvement should in the immediate future be confined to extending the north breakwater shoreward.

The amount expended under the existing project up to the close of the fiscal year ending June 30, 1908, was $15,469.78, of which $2,098.66 was for maintenance.

The expenditures during the fiscal year have been principally for extension of breakwater under existing contract, for minor repairs to piers and breakwater, and for dredging for restoration of channel. Work on the 200-foot extension to the breakwater is now in progress, and it is expected the extension will be completed in 1908.

It is proposed to expend the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, in repairs of piers and dredging for maintenance of channel.

The maximum draft that could be carried June 30, 1908, was about 20 feet. The usual mean annual variation of level of water surface is about 1 foot.

Connecting with the westerly end of the Government improvement, Sheboygan River is navigable for a distance of 1½ miles.

The commerce of Sheboygan is quite large and of a general character.

It is believed that the project has an economic effect in the handling of bulk commodities, such as coal, grain, etc., both locally and for transshipment. It is impracticable to estimate the amount of reduction in rates thereby effected.

For references to more extended information, maps, and reports on examinations and surveys, see Annual Reports for 1904, page 527, and 1906, page 645.

Commercial statistics for 1907.—Arrivals of vessels, 695; shipments and receipts, 1,259,950 net tons.

July 1, 1907, balance unexpended		$49,906.53
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$11,730.02	
For maintenance of improvement	1,926.27	
		13,656.29
July 1, 1908, balance unexpended		36,250.24
July 1, 1908, outstanding liabilities		2,669.98
July 1, 1908, balance available		33,580.26
July 1, 1908, amount covered by uncompleted contracts		15,519.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		17,000.00

(See Appendix K K 12.)

13. Port Washington Harbor, Wisconsin.—The natural channel at the mouth of the Sauk River was narrow, and at the shoalest point had a depth of 1 foot. The present harbor was not available for purposes of commerce.

The orignal project, adopted in 1869, provided for a channel between parallel piers, 150 feet apart, extending from the shore to the

11-foot contour, and for a basin 600 feet long by 200 feet wide, inside the shore line, modified as follows: June 7, 1877, extending piers to 15-foot contour and a second basin to the northward and nearly at right angles to the first basin, the depth in channel and basins to be 13 feet. The original project, as modified, is the existing project. Estimated cost, $181,527.17.

The existing project was completed in 1895 at a cost of $184,484.39.

The amount expended up to June 30, 1908, was $201,946.15, of which $2.318.09 was for maintenance. Of this amount $68.25 was derived from miscellaneous sources.

The expenditures during the fiscal year have been for maintenance of channel and for general supervision.

It is proposed to expend the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, in repairs of piers and dredging for maintenance of channel.

The maximum draft that could be carried June 30, 1908, was about 13 feet. The usual mean annual variation of levels of water surface is about 1 foot.

The volume of commerce benefited is small, and is of a local character.

It is believed that the project has no material effect in controlling freight rates, except on coal for local consumption. For reasons stated in his report the district officer considers the value of a harbor of the depth provided by this project as less than the cost of maintenance.

For references to more extended information and for reports on examinations and surveys see Annual Report for 1904, pages 528 and 2899.

Commercial statistics for 1907.—Arrivals of vessels, 1,342; shipments and receipts, 50,037 net tons.

July 1, 1907, balance unexpended	$3,468.89
June 30, 1908, amount expended during fiscal year for maintenance of improvement	446.79
July 1, 1908, balance unexpended	3,022.10
July 1, 1908, outstanding liabilities	910.58
July 1, 1908, balance available	2,111.52
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	16,000.00

(See Appendix K K 13.)

14. Milwaukee Harbor, Wisconsin, including harbor of refuge.—Milwaukee Harbor and the harbor of refuge, which were originally separate works, were consolidated by the act of June 13, 1902.

The original depth of water at the mouth of the Milwaukee River was not more than 4½ feet, and the present harbor was not available for purposes of commerce; but the situation of the entrance, in a bay protected from storms, except those from northeast to southeast, and the 7 miles of interior river easily susceptible of improvement, have made the problem of obtaining a harbor a relatively inexpensive one.

The original project for the improvement of Milwaukee Harbor was adopted in 1845–46, and provided for dredging the original river mouth and protecting the entrance by parallel piers, modified as follows: 1852, provided for the formation of a channel 260 feet wide and 13 feet deep, located 3,000 feet to the northward of original mouth of the Milwaukee River, by dredging across the overlapping point and protecting the channel by parallel piers, each 1,120 feet long; 1868, provided for extending each pier 600 feet; 1899, provided for deepening the channel to 21 feet; 1902, provided for concrete superstructure on 1,050 feet of the north pier; 1905, provided for completing concrete superstructure on north pier, a distance of 600 feet.

The original project for the harbor of refuge was adopted in 1881 and provided for a breakwater 7,650 feet long, including an opening therein of 400 feet; the acts of 1902 and 1905 provided for concrete superstructure on 3,450 feet of the northern end of the breakwater.

These original projects as modified were completed in 1906. The total amount expended thereon, including maintenance up to the time of adoption of the present project, is $1,727,426.33.

The act approved March 2, 1907, provides for maintenance of 21-foot channel, rebuilding south pier, building 3,800 feet of concrete superstructure on breakwater, and modifies the project by providing for an extension of the breakwater 1,000 feet, authorizing an expenditure for these purposes of $592,000, all of which has been appropriated.

The amount expended under the existing project up to the close of the fiscal year ending June 30, 1908, was $168,157.14, of which $167,712.63 was for maintenance.

The expenditures during the fiscal year have been principally for concrete superstructure on breakwater, for stone, and for fir timber for breakwater extension, and for timber purchased for repairs and stored at Kewaunee, Wis. About 1,940 feet of concrete superstructure has been completed; the stone foundation for breakwater extension is nearly completed, and several cribs have been constructed, but no crib has yet been sunk.

The maximum draft that could be carried June 30, 1908, was 21 feet. The mean annual variation of level of water surface is about 1 foot.

Milwaukee stands among the leading lake ports in the extent and value of its water-borne commerce. To Milwaukee 4,172,028 tons of coal was brought in 1907, to be locally consumed or distributed to points in the interior. By means of car ferries, which ply both winter and summer, Milwaukee is connected with several railway systems terminating on the east shore of Lake Michigan. The total freight movement by way of the harbor aggregated about 5,894,492 tons for the calendar year 1907.

By reason of its excellent harbor the manufacturers and distributors of Milwaukee enjoy superior shipping facilities and low freight rates, especially to and from eastern points. Many bulky articles, such as coal, salt, sugar, etc., are transshipped from water to rail at Milwaukee. The favorable effect of the harbor upon commerce is widespread throughout several States lying to the westward.

For references to more extended information and for reports on examinations and surveys, see Annual Report of the Chief of Engineers for 1904, pages 529 and 530.

Commercial statistics for 1907.—Arrivals of vessels, 5,545; shipments and receipts, 5,894,492 net tons.

July 1, 1907, balance unexpended	$234,388.24
Miscellaneous receipts	3,391.66
Amount appropriated by sundry civil act approved May 27, 1908	392,000.00
	629,779.90
June 30, 1908, amount expended during fiscal year for maintenance of improvement	161,847.04
July 1, 1908, balance unexpended	467,932.86
July 1, 1908, outstanding liabilities	20,707.63
July 1, 1908, balance available	447,225.23
July 1, 1908, amount covered by uncompleted contracts	265,170.03

(See Appendix K K 14.)

15. Milwaukee (inner) Harbor, Wisconsin.—The original condition of the rivers comprised in the inner harbor of Milwaukee is not definitely known. These rivers have been dredged, and a depth of about 21 feet below datum maintained therein, by the city of Milwaukee.

The original project, which is the existing project, was adopted by act of March 3, 1905, and provides for improving Menominee, Milwaukee, and Kinnickinnick rivers, which constitute the inner harbor of Milwaukee. This project provides for the excavation of four turning basins—one in the Menominee and three in the Kinnickinnick; the excavation of a channel 100 feet wide from the turning basin in Menominee River to its mouth and 150 feet wide thence to the harbor entrance; the excavation of a channel 100 to 150 feet wide from the mouth of the Kinnickinnick to the uppermost turning basin in that river, all channels to be 21 feet deep. The estimated cost of this improvement is $318,581. The act in adopting the project provided that no part of the appropriation therefor should be expended unless the Secretary of War shall have satisfactory assurance that the city of Milwaukee will comply with certain conditions. Stated briefly the city must donate the land for the turning basins; must revet channels and basins wherever necessary, and must maintain the improvement after its completion.

By act approved June 30, 1906, Congress authorized the Secretary of War, in his discretion, to modify this project by omitting the turning basin at the head of navigation in the Kinnickinnick River.

By act approved May 28, 1908, Congress authorized the Secretary of War, in his discretion, to enter into a contract or contracts for the improvement of the Kinnickinnick River, as soon as the city of Milwaukee shall have complied with the foregoing conditions, so far as they apply to the Kinnickinnick River, or any part thereof.

The work is to be done under continuing contract, but nothing has yet been done.

There has been no expenditure under the existing project, no assurance having yet been offered that the city of Milwaukee will fulfill the conditions above mentioned.

The maximum draft which could be carried June 30, 1908, was about 20 feet. The usual mean annual variation of water surface is about 1 foot. The rivers are actually navigable as follows: Milwaukee River, about 2¾ miles; Menominee River, about 2 miles; Kinnickinnick River about 2¼ miles.

The commerce of Milwaukee has already been described in the report relating to Milwaukee Harbor.

It is believed that the project will have a material effect in controlling freight rates on bulk commodities, such as coal, grain, and ore, both locally and for transshipment. It is impracticable to estimate the amount of reduction in rates thereby effected.

For report on examination and survey see Annual Report for 1904, Part 3, page 2887.

July 1, 1907, balance unexpended	$100,000.00
July 1, 1908, balance unexpended	100,000.00
Amount (estimated) required for completion of existing project	218,581.00

(See Appendix K K 15.)

16. Racine Harbor, Wisconsin.—The entrance to this harbor at the mouth of Root River originally varied in depth from absolute closure after storms to about 7 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1842–43, provided for a channel 13 feet deep between parallel piers 160 feet apart, modified as follows: 1866, provided for increasing depth to 16 feet and for extension of piers; 1889, provided for increasing depth to 17 feet and for further extension of piers; 1899, provided for widening channel and increasing depth to 21 feet, for extending the south pier, and for a breakwater 600 feet long; 1902, provided for a change in the location and direction of the breakwater.

The original project as modified was completed in 1905. The total amount expended thereon, including maintenance up to the time of adoption of present project, is $507,141.72.

The existing project, adopted by Congress March 2, 1907, provides for maintenance of 21-foot channel and works incident thereto, for extension of north breakwater, for a south breakwater, and for subsequent necessary extensions to each breakwater, in general accordance with type plan as set forth in report submitted in House Document No. 62, Fifty-ninth Congress, first session.

An estimate of the cost of a part of this project, amounting to $225,000, was submitted December 13, 1906, and published in River and Harbor Committee Document No. 3, Fifty-ninth Congress, second session. The Board of Engineers for Rivers and Harbors in its report on this project, published in the same committee document, stated that it was the belief of the board that the proposed plan "should be held in abeyance until the completion of the proposed improvements at Ludington and Manitowoc, and that the adoption of a new plan for the improvement of any of these other harbors" (including Racine) "should be postponed until the efficiency of the work at these two harbors is demonstrated."

If, however, it should be decided not to hold the proposed plan in abeyance, it is believed that the work of improvement should in the immediate future be confined to extending the north breakwater shoreward.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1908, is $18,258.71. Of this amount, $12,112.03 was for maintenance.

The expenditures during the fiscal year have been for extension of north breakwater, for maintenance of channel, and for general supervision.

It is proposed to expend the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, in repairs of piers and dredging for maintenance of channel.

The maximum draft that could be carried June 30, 1908, was about 19 feet. The usual mean annual variation of level of water surface is about 1 foot.

Connecting with the western terminus of the Government improvement, Root River is navigable for a distance of about nine-tenths of a mile.

It is believed that the project serves a useful economic purpose in connection with the handling of bulk commodities, such as coal, both locally and for transshipment, and that freight rates on locally manufactured articles and the raw materials required therefor are reduced by the competing rail and water routes.

For references to more extended information and reports on examinations and surveys, see Annual Reports for 1904, page 531, and 1906, page 645.

Commercial statistics for 1907.—Arrivals of vessels, 1,441; shipments and receipts, 497,752 net tons.

July 1, 1907, balance unexpended		$49,083.62
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$6,046.68	
For maintenance of improvement	7,352.90	
		13,399.58
July 1, 1908, balance unexpended		35,684.04
July 1, 1908, outstanding liabilities		5,036.45
July 1, 1908, balance available		30,647.59
July 1, 1908, amount covered by uncompleted contracts		21,380.94
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		20,000.00

(See Appendix K K 16.)

17. Kenosha Harbor, Wisconsin.—The original depth of water at the mouth of Pike Creek varied from nothing to 4 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1852, provided for a channel 13 feet deep between parallel piers 150 feet apart, modified as follows: 1866, provided for a navigable channel 16 feet deep; 1889, provided for extending north pier 300 feet and south pier 600 feet, and for channel 16 feet deep; 1890, provided for dredging in "The Basin;" 1899, provided for extending the south pier, increasing the width between piers to 250 feet by rebuilding the north pier, building 600 feet of breakwater, and increasing the depth in channel and basin to 21 feet and 20 feet, respectively; 1902, provided for extending the breakwater 100 feet shoreward.

The original project as modified was completed in 1900, with the exception of 100 feet extension to breakwater. The total amount expended thereon, including maintenance up to the time of adoption of present project, is $475,815.37.

The existing project, adopted by Congress March 2, 1907, provides for maintenance of 21-foot entrance channel, 20-foot basin, and exist-

ing works, and for an extension of 200 feet to the landward end of the breakwater, for which $22,000 was appropriated.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1908, is $7,131.83. Of this sum, $1,049.18 was for maintenance.

The expenditures during the fiscal year have been for extension of north breakwater, for dredging, and for general supervision.

It is proposed to expend the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, in repairs of piers and dredging for maintenance of channel.

The maximum draft that could be carried June 30, 1908, was about 19 feet. The usual mean annual variation of level of water surface is about 1 foot.

Connecting with the western terminus of the Government improvement, Pike Creek is navigable for a distance of about 2,500 feet.

The volume of commerce is not large and is chiefly of a local character.

It is believed that the project has an effect in controlling freight rates on locally manufactured articles and coal for local consumption.

For references to more extended information and for reports on examinations and surveys, see Annual Reports for 1904, page 532, and 1906, page 645.

Commercial statistics for 1907.—Arrivals of vessels, 369; tonnage, 103,127.

July 1, 1907, balance unexpended		$40,091.82
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$5,982.65	
For maintenance of improvement	591.25	
		6,573.90
July 1, 1908, balance unexpended		33,517.92
July 1, 1908, outstanding liabilities		4,389.38
July 1, 1908, balance available		29,128.54
July 1, 1908, amount covered by uncompleted contracts		28,623.97
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		30,000.00

(See Appendix K K 17.)

18. Waukegan Harbor, Illinois.—Originally there was no navigable channel or natural harbor at this place.

The original project was adopted in 1880 and provided for an artificial harbor of sufficient capacity for local trade by inclosing an area with pile piers, the entrance channel and inclosed area to be dredged to 13 feet.

The amount expended on original project prior to commencement of operations under present project was $218,944.41.

The existing project, adopted by act of June 13, 1902, provides for extending both harbor piers, building a breakwater, and increasing depth of channel to 20 feet; estimated cost, $345,000, all of which has been appropriated.

This project was completed in 1904; since then the expenditures have been for maintenance.

The total amount expended in the work of existing project up to the close of the fiscal year ending June 30, 1908, is $376,353.15; of this sum $66,013.76 was for maintenance, of which amount $72.93 was derived from miscellaneous sources.

The expenditures during the fiscal year have been principally for reconstruction of inshore end of south pier, and dredging for restoration of channel.

It is proposed to expend the amount estimated as a profitable expenditure in fiscal year ending June 30, 1910, for maintenance of piers and channel.

The maximum draft which could be carried June 30, 1908, was about 19 feet. The usual mean annual variation of water level is about 1 foot.

The commerce affected by the project is mostly coal and salt for transshipment. Its volume is large and increasing.

It is believed that the harbor is of great convenience to general commerce, being a terminus of the Elgin, Joliet and Eastern Railway, known as the Chicago Outer Belt Line. The harbor is in close connection with all the railways entering Chicago.

For reference to more extended information, maps, and reports on examinations and surveys, see Annual Report for 1904, page 532.

Commercial statistics for 1907.—Arrivals of vessels, 544; shipments and receipts, 384,986 net tons.

July 1, 1907, balance unexpended	$68,159.94
June 30, 1908, amount expended during fiscal year for maintenance of improvement	17,884.57
July 1, 1908, balance unexpended	50,275.37
July 1, 1908, outstanding liabilities	2,889.02
July 1, 1908, balance available	47,386.35
July 1, 1908, amount covered by uncompleted contracts	29,160.19
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	18,000.00

(See Appendix K K 18.)

19. Fox River, Wisconsin.—The Fox and Wisconsin rivers, separated at Portage, Wis., by a distance of only 2 miles, one flowing into Lake Michigan, the other into the Mississippi River, were the early means of communication between those waters. Through a board of public works the State began and carried on the improvement until 1853, when it was transferred to a private company. In 1872 the United States purchased from the Green Bay and Mississippi Canal Company all of its property except the water powers, water-power lots, and personal property.

The present project is that of a Board of Engineers, submitted September 17, 1884, and modified May 14, 1886. It provides for deepening and widening the channel of Fox River from Green Bay to Montello to 6 feet depth and from Montello to Portage to 4 feet

depth, with a width of the river channel from Lake Winnebago to Montello of 100 feet, and for the renovation of 12 old locks, at an estimated cost of $602,000.

Appropriations aggregating $573,750 have been provided for this work and a revision of the estimate indicates that $175,353.36 will be required to complete it.

The river and harbor act of March 2, 1907, provided for maintenance of harbors at Stockbridge, Fond du Lac and Calumet, and authorized $5,000, or so much thereof as may be necessary, for dredging and otherwise improving the harbor at Brothertown, on Lake Winnebago.

The improvement of the Wisconsin River was abandoned in 1887.

The amount expended on the improvement of the Fox and Wisconsin rivers from 1867 to the close of the fiscal year ending June 30, 1908, not including about $1,700,000 expended for flowage damages and for the operation and care of the works, but including $145,000 paid to the Green Bay and Mississippi Canal Company for its property, was $3,195,371.37, of which amount $591,161.39 was expended solely upon the Wisconsin River.

The works on Fox River now consist of 18 stone locks, 2 stone guard locks and 8 composite locks, 13 canals, 16 permanent and 1 temporary dam, and various accessories, including lock houses, warehouses, a dry dock, levees, waste-weirs, culverts, retaining walls, etc. The harbors of Stockbridge, Calumet, and Miller Bay, Lake Winnebago, have been improved; work has been commenced on a harbor at Brothertown, and snags have been removed and bars dredged in Wolf River, making a 4-foot channel 100 feet wide to New London.

The project depth of 6 feet below mean low water has for the most part been obtained from Depere to Princeton lock, a small amount of dredging remaining to be done in the upper ends of the pools between Berlin and Princeton lock, where now but 5-foot depths obtain. The dredging of the 6-foot channel between Princeton lock and Montello is now in progress, and the next appropriation will be applied to this section.

The district officer states in his report that the value of the improvement to commerce is so small as to be incommensurate either with its first cost or the cost of its maintenance, and that that portion of Fox River lying above Montello is believed to be unworthy of further improvement.

The maximum draft that could be carried June 30, 1908, at mean low water over the shoalest part of the improvement was 5 feet from Depere to Berlin lock, 4 feet from there to Princeton lock and 3 feet from Princeton lock to Portage, the head of navigation on the Fox River.

July 1, 1907, balance unexpended	$82,259.97
Miscellaneous receipts	9.00
	82,268.97
June 30, 1908, amount expended during fiscal year for works of improvement	29,710.60
July 1, 1908, balance unexpended	52,558.37
July 1, 1908, outstanding liabilities	2,680.27
July 1, 1908, balance available	49,878.10

Amount (estimated) required for completion of existing project	$175,353.36
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	75,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix K K 19.)

20. Operating and care of locks and dams on Fox River, Wisconsin.—Under the allotment from the indefinite appropriation for operating and care of canals and other works of navigation there has been expended during the year ending June 30, 1908, the sum of $45,171.78.

The amount expended to June 30, 1908, is $1,354,465.57, including $3,157.75 miscellaneous receipts.

The principal work done has been dredging bars and channels; making repairs to locks, dams, and canal banks, lock-houses, dredges, and boats; renewing the timber work and concrete top finish of Depere lock above low water, and renewing the concrete top finish and rebuilding the gates of Menasha lock. The report of the district engineer officer in charge shows the items of expenditures. Navigation was closed November 22, 1907, and reopened April 6, 1908.

For commercial statistics, see report of the district officer upon the improvement of Fox River, Wisconsin.

(See Appendix K K 20.)

21. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Wreck of steamer City of Glasgow in Green Bay Harbor, Wis.*—This vessel burned December 3, 1907, and sunk in the dredged channel about one mile inside of Tail Point light, completely blocking the channel.

The wreck having been abandoned by its owners, the United States, on January 8, 1908, entered into contract for its removal.

On May 23, 1908, the wreck was entirely removed.

(*b*) *Wreck of schooner R. H. Becker in Sheboygan Harbor, Wis.*—This vessel capsized May 7, 1908, between the piers near the entrance to Sheboygan Harbor, Wis., forming a dangerous obstruction to navigation.

The wreck having been abandoned by its owners, it was removed by the United States at a cost of $887.67.

(See Appendix K K 21.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of Menominee Harbor, Michigan, with a view to the construction of a breakwater.—Report dated April 25, 1907, is printed in House Document No. 73, Sixtieth Congress, first session. Improvement of the locality in the manner proposed is not considered worthy of being undertaken by the United States.

2. Preliminary examination with plan and estimate of cost of improvement of Kewaunee Harbor, Wisconsin, with a view to obtaining depths of 18 and 20 feet, respectively.—Reports dated April 12 and July 25, 1907, respectively, are printed in House Document No. 324, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $53,690 is presented.

Section 3 of the river and harbor act of March 2, 1907, also authorized a preliminary examination and survey of *Algoma (Ahnapee) Harbor, Wisconsin, with a view to the construction of an outer harbor and obtaining a channel 16 feet in depth.* Improvement of the locality "by the construction of an outer harbor with a depth of 16 feet of water" having been provided for by an item in section 1 of the same act, further examination and report under authority contained in section 3 is not necessary.

IMPROVEMENT OF RIVERS AND HARBORS IN THE FIRST CHICAGO, ILLINOIS, DISTRICT.

This district was in the charge of Col. W. H. Bixby, Corps of Engineers, division engineer of the northwest division to February 15, 1908, and of the western division since that date.

1. Chicago Harbor, Illinois.—Before improvement (1870) this harbor was limited to the lower end of Chicago River, with an entrance channel width of 400 feet, depth of 13 feet, and annual commerce less than 3,000,000 tons. A brief history of this harbor improvement prior to 1876 is given on pages 433 to 438, Part 2, Annual Report of the Chief of Engineers for 1876, and a very full description of the harbor in its improved condition is to be found on pages 131 to 134, Bulletin No. 18 (1908), issued by the United States Lake Survey Office, Detroit, Mich.

The present project was adopted in 1870, modified in 1878, 1896, 1903, and 1905; that for present increased depth of dredging in outer harbor being given by report of July 16, 1897 (p. 2791, Annual Report of the Chief of Engineers for 1897), specifically adopted by act of March 3, 1899; and that for repair of north pier being given by report of July 14, 1903 (p. 1888, Annual Report of the Chief of Engineers for 1903), adopted by act of March 3, 1905; such projects including:

(*a*1) Breakwaters to form an outer harbor, with (*a*2) dredging within the same for 20-foot draft (21-foot depth).

(*b*) Exterior breakwater, with a harbor of refuge behind the same.

(*c*) Dredging entrance to inner harbor or mouth of Chicago River to same depth as outer harbor.

(*d*) Maintenance; including (*d*1) the special repair of north pier superstructure and (*d*2) some redredging outside the southern entrance to the basin.

(*e*) Contingencies, including superintendence.

For map of full improvement, see page 1888, Annual Report of the Chief of Engineers for 1903.

No preliminary examination reports appear to be on record as to past improvements of this locality.

A list of past survey reports will be found on page 600, Annual Report of the Chief of Engineers for 1906.

There has been expended in all on this work to June 30, 1908, the sum of $2,056,510.45, of which $270,573.99 is under estimates of the *1897* and *1903* projects.

The portions of the above project now in hand are (*a*2) completion of dredging of the outer harbor basin for a 20-foot draft, estimated July 16, 1897, at $509,960; (*d*1) completion of repair of north pier superstructure, estimated July 14, 1903, at $85,000; (*d*2) reopening (dredging) of the east (also called southern) entrance to the outer harbor basin; (*d*3) redredging of the entrance to Chicago River from the lake to Rush Street Bridge; (*d*4) repair of outer harbor breakwater cribs and filling; (*d*5) repair of exterior harbor of refuge breakwater; (*e*) contingencies, including superintendence.

At present the harbor entrance has a width of 470 feet at the river mouth, with a least depth of 21 feet via Chicago River, and of about 16 feet via the basin entrance; and the harbor basin carries depths of at least 19 to 20 feet over its outer half (portion fully dredged) and of at least 8 feet over its inner half; all these depths being referred to "Chicago city datum," or the so-called "low water of 1847," which is 579.83 feet above mean tide, New York Harbor (Lake Survey revisions of 1907).

The water level has a total variation of about 6.5 feet from highest known to lowest known water, and an average of less than 1 foot oscillation per day. Its average for the calendar year of 1907 was 580.67 feet above mean tide, New York Harbor, or 0.73 foot above Chicago city datum.

Chicago outer harbor, being mainly a protection to Chicago River entrance, has practically no commerce except that of the river, the outer basin being used mainly by yachts and other small craft. The lake commerce of this locality is at present diminishing, and the harbor works, while formerly having added about 5,000,000 tons to the river commerce, are now needed mainly to prevent a more rapid loss of the 5,000,000 tons now remaining.

The existence of this improved harbor is considered to be of great use in controlling freight rates.

By act approved May 28, 1908 (Public, No. 153), any or all of the then available balance for Chicago Harbor is made available, in the discretion of the Secretary of War, for expenditure on the existing project for Chicago River.

It is proposed to apply the available funds and the further recommended appropriation toward the completion of the project by dredging in the outer basin, by rebuilding in concrete the superstructure of the north pier, by maintaining existing works, and to use some of these funds upon dredging in the Chicago River, meanwhile postponing for a while the outer basin dredging, which is not urgent.

July 1, 1907, balance unexpended		$340,859.59
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$14,779.17	
For maintenance of improvement	46,654.41	
		61,433.58
July 1, 1908, balance unexpended		279,426.01
July 1, 1908, amount covered by uncompleted contracts		42,686.57
Amount (estimated) required for completion of existing project		44,960.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		54,960.00

(See Appendix L L 1.)

2. *Chicago River, Illinois.*—Before improvement by the United States (1896) the river channel, as a result of municipal and private improvement, was navigable for about 14-foot draft boats over widths of about 200 feet throughout the length of the main river, about 1.5 miles, and of use by boats of 12 to 14 feet draft for lesser widths and for about 5 miles farther length in the North Branch, and about 5 miles farther length in the South Branch and forks. A good brief history of river and harbor improvement at Chicago prior to 1876 is given on pages 433–438, Part 2, Annual Report of the Chief of Engineers for 1876, and a very full description of present conditions is to be found on pages 134–144, Bulletin No. 18 (1908), issued by the United States Lake Survey Office, Detroit, Mich. For maps of river and turning basins, see pages 1892–1893, Annual Report, 1903.

Past projects, from 1896 to 1902, provided for 16 feet draft through this river. Under such projects 17 feet actual depth below city datum was secured from the mouth of the river via South Branch and West Fork to Ashland avenue (about 5.5 miles), via South Branch and South Fork to the stock yards (about 6 miles), and via North Branch to Belmont avenue (about 6 miles). (See p. 2974, Annual Report of the Chief of Engineers for 1893; p. 2793, Report for 1897, and p. 3865, Report for 1900, for full reports on history of improvement and needs up to 1899.)

The project of July 2, 1902, estimated cost $500,000, as specifically covered by act of Congress June 13, 1902, provided for two large turning basins (one in the North Branch and one in the South Branch), to be dredged to 20 feet draft (21 feet depth). These turning basins have been completely dredged and partly docked, but will need some annual redredging and probably some further dock revetment.

A list of past survey reports will be found on page 601, Annual Report of the Chief of Engineers for 1906.

Reference to reports on examination and survey of West Fork of South Branch of Chicago River, ordered by the river and harbor act of March 3, 1905, will be found on page 608, Annual Report of the Chief of Engineers for 1906.

There has been expended on projects prior to 1902 $448,520.51, and on the project of 1902, to June 30, 1908, the sum of $467,810.03. Total, $916,330.54.

The only other work still to be done in this river in connection with above projects is that of ordinary repair and maintenance, estimated at about $10,000 per annum.

The river and harbor act, March 2, 1907, appropriated $300,000 for improvement and maintenance of this river, such work being covered by the survey report of November 14, 1899 (pp. 3865–3871, Annual Report of the Chief of Engineers for 1900), and providing for dredging to 21 feet actual depth in mid-channel and to within 20 feet of dock lines from Ogden slip at the river mouth to Ashland avenue on the South Branch, to the Indiana State line bridges on the South Fork, South Branch, and to Belmont avenue on the North Branch (including also the canal around Goose Island, North Branch), all originally estimated at $810,600. Project covering this work was approved as follows:

(a) Dredging soft material, main river, North Branch (including canal), South Fork of South Branch, 1,472,000 cubic yards	$384,000
(b) Excavation rock and hard pan in North Branch and South Fork, 105,000 cubic yards	352,800
(c) Superintendence and inspection	73,800
	810,600

the division of funds between dredging and excavation being subject to modification during the progress of work.

Tunnels under Chicago River.—Under act of Congress approved April 27, 1904, the owners of the three tunnels under the Chicago River (by which the available draft in the river was reduced to 17 feet) were ordered to have these tunnels removed or lowered sufficiently to leave over them a clear depth of 22 feet. As a result of such orders, the La Salle Street Tunnel has now been removed to a depth of 26 feet over about 200 feet center width of river; the Washington Street Tunnel has been lowered to a least depth of 22 feet and full river width; and the Van Buren Street Tunnel has been lowered to a least depth of 23 feet for a least width of 160 feet in the middle of the river.

At present the river, including both branches, slightly widened at its narrowest parts by the United States and much widened in the South Branch by the Chicago Sanitary District, has a least depth of channel, as referred to Chicago city datum, of 21 feet from the lake to Clark Street Bridge, thence 19 feet to its branches; thence in the North Branch 17 feet to the north turning basin and 10 feet to Belmont avenue; and in the South Branch 17 feet to the south turning basin and through the West Fork and Sanitary District Canal to Lockport; and in the South Fork 17 feet to the stock yards. (For general description of the sanitary district projects, see p. 2097, Annual Report of the Chief of Engineers for 1902.)

The water level has variations of about 6.5 feet from the highest known to lowest known water, and an average of less than 1 foot per day. The river has a current from the lake toward the Sanitary District Canal varying from nothing up to about 3 miles per hour, according to drainage diversion and lake seiches.

The annual commerce is now reported at about 5,000,000 tons, the principal items being grain, lumber, coal, and salt (a good deal of the local commerce having, since 1897, gone to the Calumet River), and the present further improvement is now mainly needed to prevent further loss.

The existence of this improved river is considered to be of great use in controlling freight rates.

By act approved May 28, 1908 (Public No. 153), any or all of the available balance for Chicago Harbor is made available, in the discretion of the Secretary of War, for expenditure on the existing project for Chicago River. This arrangement practically authorizes a temporary loan of harbor funds to the river funds so as to allow of immediate prosecution of dredging contracts pending the full appropriation for completion of the urgently needed river work. One more appropriation similar to that of 1907 will provide in Chicago River for depths and widths sufficient to allow of its navigation by the largest boats of the Great Lakes up to where they are stopped by the city bridges. Thereafter appropriations should be held back

until the city removes the center piers and widens the draws of its bridges.

It is proposed to apply the funds now available and further appropriations to the completion of the turning basins, to the securing of the new 21-foot depth throughout the river, and to the maintenance of existing works.

July 1, 1907, balance unexpended		$349,095.09
June 30, 1908, amounted expended during fiscal year:		
For works of improvement	$3,204.94	
For maintenance of improvement	4,042.57	
		7,247.51
July 1, 1908, balance unexpended		341,847.58
July 1, 1908, amount covered by uncompleted contracts		277,374.90
Amount (estimated) required for completion of existing project		510,600.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		300,000.00

(See Appendix L L 2.)

3. Calumet Harbor, Illinois.—This harbor is known on the Great Lakes as South Chicago Harbor.

Before improvement (1870) this harbor was limited to the lower end of Calumet River and to the natural depths over the bar at its lake mouth, the channel entrance having about 100 feet available width with about 4 feet depth. The annual commerce was practically nothing in either harbor or river. A brief history of this harbor improvement prior to 1876 is given on pages 441–444, Part 2, Annual Report of the Chief of Engineers for 1876; and a very full description of present conditions is to be found on pages 124–125, Bulletin No. 18 (1908), issued by the United States Lake Survey Office, Detroit, Mich.

This improvement was designed to furnish a safe and practicable entrance to Calumet River and the port of South Chicago by the construction of parallel piers 300 feet apart, projecting from the shore into Lake Michigan, and by dredging between them.

The work began in 1870, and all the projected work for 16 feet draft was accomplished prior to June 30, 1896, resulting in the construction of 3,640 linear feet of north pier and 2,020 linear feet of south pier, and securing and maintaining a channel 16 feet deep and of suitable width from water of similar depth in Lake Michigan to the Calumet River at the roots of the piers, at a cost of $454,483.53.

The present project, submitted February 21, 1896, and specifically adopted by Congress by act of March 3, 1899 (including minor changes submitted March 28, 1899, modified July 1, 1902, and approved by Secretary of War July 11, 1902), provides for—

(*a*) A breakwater 4,400 feet long, connected with the shore and running due east into the lake, terminating in water 32 feet deep.

(*b*) An extension of this breakwater 2,500 feet long in a southeasterly direction from the end of the first.

(*c*) The anchorage area sheltered by breakwater dredged to 20 feet draft (21 feet depth).

(*d*) South pier at the mouth of Calumet River extended 800 feet.

(*e*) The Calumet River dredged to a width of 200 feet and 20 feet draft (21 feet depth) for a distance of 2 miles from the mouth.

(*f*) Maintenance and repairs.

For text and map, including minor changes, see pages 2583–2588, Annual Report of the Chief of Engineers for 1896, and page 2102 of the report for 1902.

A statement of past examination and survey reports will be found on page 603, Annual Report of the Chief of Engineers for 1906.

There has been expended on this work to June 30, 1908, the sum of $1,456,722.63, of which $1,002,238.10 is under the existing project of 1896.

All original work of past and existing projects has now been completed, leaving since 1905 only its repair and other maintenance.

At present the protected harbor behind the lake breakwater is about 0.5 square mile in area with 20 feet depth; and the pier entrance to the river is of 300 feet width with at least 20 feet channel depth; all depths being referred to Chicago city datum. (See Chicago Harbor report.)

The water level has a total variation of about 6.5 feet from the highest known to lowest known water, and an average of less than 1 foot oscillation per day. Its average for the calendar year of 1907 was the same as that for Chicago Harbor.

Calumet Harbor, being mainly a protection to Calumet River entrance, has practically no commerce except that of Calumet River, although about half of the Illinois Steel Company's commerce, belonging partly to the harbor and partly to the river and estimated herewith, as usual, under Calumet River, belongs strictly to the harbor. The harbor works are fully entitled to half the credit of all the commerce developed by the combined harbor and river improvements since 1870, such development having now reached about 6,000,000 tons annually.

The existence of this improved harbor is considered to be of great use in controlling freight rates, and is claimed to save at least 50 cents per ton over Chicago River rates, and more over the usual Calumet (South Chicago) railroad rates.

It is proposed to apply the funds now available to the necessary repair and other maintenance of the works.

July 1, 1907, balance unexpended	$113,346.46
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,838.09
July 1, 1908, balance unexpended	110,508.37
July 1, 1908, amount covered by uncompleted contracts	16,612.50

(See Appendix L L 3.)

4. Calumet River, Illinois and Indiana.—Before improvement of Calumet Harbor by the United States (1870), this river, while having a navigable channel of about 100 feet width and 13 feet depth for about 4 miles length, could not be reached from the lake by boats of over 5 feet draft, because of the bar across its lake mouth; and its commerce was then practically nothing. At the time of the improvement of the river itself (1884), the river had become navigable for 12 feet draft over widths of about 100 feet and a length of about 4 miles; and for boats of 5 feet draft over widths of about 50 feet and lengths

from the river mouth of about 16 miles in the Grand Calumet and about 14 miles in the Little Calumet. The commerce at that time was, however, less than 500,000 tons. A good brief history of this river and harbor improvement prior to 1876 is given on pages 441–444, Part 2, Annual Report of the Chief of Engineers for 1876, and a very full description of present conditions is to be found on pages 125–128, Bulletin No. 18 (1908), issued by the United States Lake Survey Office, Detroit, Mich.

The project for the improvement of this river, adopted by Congress in 1884 and modified in 1886, contemplated securing a channel 200 feet in width and 16 feet in depth below low water in Lake Michigan from the mouth of Calumet Harbor, Illinois, about 11 miles upward, to a point one-half mile east of Hammond, Ind. This project was modified by the river and harbor act of June 3, 1896, for Calumet Harbor, so as to provide for dredging the channel to 20 feet depth from the mouth 2 miles southward (upward).

The projects of 1884 to 1896, now ended, secured a permanent channel of 200 feet width and 20 feet depth from the mouth of the river about 2.5 miles upstream (including a small turning basin near the mouth of the river), thence 16 feet depth about 3 miles farther, except over short portions where rock reduced the width to 85 feet and the depth to 14 feet; and, in addition a temporary channel of 10 feet depth and 60 feet width, in the next 6 miles, up to a point on the Grand Calumet one-half mile east of Hammond, Ind. (about 11 miles above the mouth).

The present projects, adopted by act of March 3, 1905, provided for a channel 200 feet wide and 20 feet deep from the mouth of the river to One hundred and twenty-second street, and of the same width and 16 feet deep from One hundred and twenty-second street to the forks, with five turning basins, at a total estimated cost of $662,480.50, and $10,000 per annum for maintenance. (See p. 605, Annual Report of the Chief of Engineers for 1906.) The construction of the turning basins was made contingent upon the donation of the necessary land to the United States free of cost.

(For estimates in full, see pp. 2942–2949, Annual Report of the Chief of Engineers for 1904; for map, see p. 1902 of the Report for 1903; also, for fuller details, see House Document No. 172, Fifty-eighth Congress, second session.)

For this work $682,500 has been appropriated, and $30,000 more of contracts authorized (and not yet appropriated), thus providing for the entire project and allowing five years of maintenance at $10,000 per year.

The act of June 13, 1902, authorizes the Secretary of War to accept deeds, free of expense to the United States, for lands necessary to make a proper channel 200 feet wide from the forks up to a point one-half mile above Hammond, Ind. (a stretch of about 5.5 miles).

Under appropriation of August 18, 1894, for "above the forks," $5,130.75 is still available, but dredging has been discontinued because of constant refilling. A resurvey of this part of the river has been made to relocate the ground in such way that owners may know just what property is to be ceded to afford the best results to navigation.

A statement of past examination and survey reports will be found on page 605, Annual Report, 1906, and reference to report on examination made in compliance with act of March 2, 1907, will be found on page 681 of this report.

There has been expended to June 30, 1908, on works of all projects, the sum of $776,363.52, of which $330,595.29, including $3,511.50 for maintenance, is under the project of 1903, adopted by act of March 3, 1905.

Expenditures up to date have resulted in a channel of 21 feet depth (Chicago datum) from the river mouth to One hundred and sixth street, with 300 feet width at the harbor piers, diminishing to 200 feet width at about Ninety-second street, retaining 200 feet width to One hundred and sixth street (except at bridges); thence 20 feet depth with 200 feet width to One hundred and eleventh street; thence 21 feet depth with 200 feet width to One hundred and fourteenth street; thence 21 feet depth with 180 feet width to One hundred and twenty-second street; thence 17 feet depth with 180 feet width to near the Calumet Western Railroad bridge (near One hundred and twenty-fourth street); thence about 5 feet mid-channel depth and 100 to 150 feet river width (undredged) to the forks, now under contract to be deepened to 17 feet depth and 200 feet width; thence about 5 feet depth with about 50 feet width (dredged prior to 1895 to 10 feet depth and to 60 feet width, but since partly filled up) to Hammond, Ind. One small turning basin has been dredged just above Ninety-second street with 250 feet least diameter and about 12 feet depth.

The river is further navigable for 6-foot draft boats to Riverdale on the Little Calumet, 12 miles from the river mouth. It can also be used by light-draft launches, such as can pass under bridges, nearly to Gary on the Grand Calumet, about 20 miles from the river mouth, and to Blue Island on the Little Calumet, about 14 miles from the river mouth, being stopped at that point by rapids.

The water level has variations of about 6.5 feet from highest known to lowest known water, and an average of less than 1 foot per day. At dead low water the river is practically level from the lake up to the junction of the Grand and Little Calumet. The current is very slight except during freshet and lake seiches.

Up to the close of the present fiscal year only one deed had been offered of land for turning basins. On June 9 was tendered a deed conveying to the United States the island in the river near Ninety-third street, and this deed is now in the hands of the Attorney-General's Department for examination prior to acceptance.

An application of the sanitary district of Chicago for permission to reverse the flow of Calumet River, so as to cause the water to flow from Lake Michigan into the drainage canal (in a similar manner as has been done in the Chicago River), was denied by the War Department March 14, 1907, and later by temporary injunction of Federal courts; and the case is now being argued. A final decision by the United States Supreme Court will probably not be reached this season.

The annual commerce is now reported at 6,400,000 tons, the principal items being iron ore, grain, and coal. It is steadily increasing, and new manufacturing plants are steadily occupying the river banks as fast as the 20-foot depths are carried upstream.

The existence of this improved river is considered to be of great use in controlling freight rates, and is claimed to save at least 50 cents per ton over Chicago River rates, and more over the usual Calumet (South Chicago) railroad rates.

It is proposed to apply the funds now available and those asked for for the year ending June 30, 1910, to continuing the enlargement of

the channel progressively upstream according to the 1903 project, adopted by act of March 3, 1905, and to the construction of the turning basins authorized under such project, as soon as the land needed therefor be deeded to the United States, and for maintenance.

July 1, 1907, balance unexpended	$407,917.30
Amount appropriated by sundry civil act approved May 27, 1908	140,000.00
	547,917.30
June 30, 1908, amount expended during fiscal year for works of improvement	190,061.84
July 1, 1908, balance unexpended	[a] 357,855.46
July 1, 1908, amount covered by uncompleted contracts	108,000.00
Amount (estimated) required for completion of existing project	30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	30,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix L L 4.)

5. *Michigan City Harbor, Indiana.*—The inner and outer harbors were formerly separate works. They are now consolidated in consequence of the requirements of the river and harbor act of June 13, 1902.

The improvement of this harbor dates from 1836, and has resulted in establishing an inner harbor for local commerce and partly completing an outer harbor designed to facilitate entrance to the former and afford refuge for vessels engaged in general lake commerce.

The inner harbor.—This has been made by deepening the entrance to Trail Creek and protecting the channel by piers extending to deep water in Lake Michigan, to which operations were limited until 1870. The original depths before improvement were 9 feet upon the outer bar and 3½ feet or less at the entrance to the inner harbor; and the width varied from 175 feet in the lower portion to 60 feet or less in the upper portion. Since 1882 the entrance channel has been prolonged up the creek by dredging between revetments, so fast as they are built on established wharf lines at the expense of the adjoining property owners, as required by city ordinance.

No recent general project for the expenditure of funds has been definitely called for; and work for the past twenty years has been based upon securing a 15-foot draft at low water to within about 25 feet of dock lines, as indicated in the Annual Reports of the Chief of Engineers for 1879 to 1882, and over a length of river from the lake up to the present Lake Erie and Western Railroad bridge, as shown on maps in the Annual Reports of the Chief of Engineers for 1882 (p. 2270) and 1896 (p. 2676). The practice in this river has been for the General Government to do all work outside the general shore line of the lake and the dredging in the river channel, and for the city or private owners to put in the docking of the river front and make necessary repairs to private slips and harbors. The maps of the 1882 and 1896 reports show a medium-sized upper turning basin, a small middle turning basin, while the appropriation of

[a] Includes $5,130.75 for "above the forks."

March 3, 1905, provided for widening the river at its lowest bend sufficient to form a large lower turning basin between the lake and the first bridge of the river (completed April 30, 1906).

A recent act of the Indiana legislature now allows the city to build revetments and to assess their cost upon the property benefited, as in cases of sewer construction; and such extensive reconstruction of revetments is soon to be made by the city as will allow the channels to be deepened by the United States to 20 feet from the entrance to Franklin Street Bridge, to 18 feet from there to the railroad bridge, and to 16 feet thence to the upper end of the harbor as soon as funds become available for such work.

In recent years the inner harbor improvement, with the exception of the lower turning basin, has been purely one of dredging, and has resulted in creating a channel 9,159 feet long between revetments from 100 to 175 feet apart, except at the turning basins, where the width is about 330 feet. The upper limit of this improved channel is 100 feet above the upper turning basin on the map above referred to; but above the lower part of the upper basin the channel has shoaled and is not available for lake vessels.

The completion of the project of 1882–1896 requires that this dredging shall be extended upstream about 1,000 feet beyond the upper turning basin (about 64,000 cubic yards, now estimated at about $16,000).

The piers forming the lake entrance to the river, originally treated as part of the inner harbor, are now treated as a part of the outer harbor and are described below under that head.

Dredging operations were carried on by the U. S. suction dredge *General Gillespie* and by a hired dredge in June; all being of the nature of maintenance.

The channel does not maintain itself, and provision should be made for periodical dredging at an expense of about $6,000 per year.

The outer harbor.—Michigan City, being at the southern end of the lake, is exposed to northerly storms, especially those from west of north, with a clear sweep of the length of the lake, about 250 miles. As a result there arose a demand for a harbor of refuge in this vicinity, which was answered in 1870 by the adoption of a project for the creation of an outer harbor at this place, which was to consist of an outer basin east of the entrance to the inner harbor. In 1882 this project was extended to include the construction of an exterior breakwater northwest of the entrance. The piers and breakwaters covering the outer basin were completed in 1885, and have a total length of 3,171 feet, measured on the harbor face, viz, a pile pier, 1,225 feet long, extending in a northwesterly direction from the shore and closing the basin on the east; a crib breakwater, 1,411 feet long, extending southwesterly from the lake end of the pile pier and closing the basin on the northwest, and a crib pier, 535 feet long, measured from the angle in the harbor face, or 505 feet measured from the rear face of the breakwater, extending northwesterly from the southwest end of the crib breakwater. The exterior breakwater contemplated by the project of 1882 was to have a total length of 2,000 feet, but a length of only 700 feet had been built.

The river and harbor act of March 3, 1899, authorized the adoption of the project of a Board of Engineers as printed in the Annual

Report of the Chief of Engineers for 1897, pages 2899 to 2904, inclusive, and provided for the completion of the work under the continuing-contract system. This project requires the extension of the old breakwater pier by 600 feet, the construction of a new detached exterior breakwater 1,500 feet long, and the removal of the old detached exterior breakwater. The estimated cost of the work was given at $282,150, but it is now evident that this sum will be exceeded.

The Annual Report of the Chief of Engineers for 1897, pages 2899 to 2904, contains the full report of the Board of Engineers referred to above, and a map showing the outlines of the present project is opposite page 2904 of that report.

On both inner and outer harbors, up to June 30, 1908, the expenditures were as follows:

Expended on previous projects, 1836 to June 30, 1902:		
For construction	$1,009,507.04	
For maintenance	187,084.80	
		$1,196,591.84
Expended on existing project of 1899, amended 1905:		
For construction	$309,621.73	
For maintenance	62,585.69	
		372,207.42
		1,568,799.26

By joint resolution of Congress approved May 13, 1908 (Public No. 23), the Secretary of War was authorized, in his discretion, to use any unexpended balance of money heretofore appropriated, or that may be hereafter appropriated for the improvement or maintenance of this harbor, for the rebuilding of the western revetment upon a new alignment, with the view of widening the channel.

The district officer estimates that to complete the original project and the channel widening will cost $16,000 for original dredging (upper end of inner harbor), $30,000 for original breakwater construction (last 200 feet length), $72,000 for the newly authorized channel entrance widening, and $62,000 for repair, maintenance, and supervision, in addition to $10,000 later each year for ordinary maintenance of redredging channel and repairing piers, for which additional appropriations of $105,000 will be required exclusive of yearly maintenance.

The funds in hand will be expended toward widening of channel entrance, completion of original project, and for maintenance and contingencies.

Information received as to the effect of the project on freight rates is meager, but indicates that in a general way the improvement has a tendency to reduce charges and secure advantageous charters for shippers. The city is growing rapidly and steadily. The present commerce is shown by tables in the appendix. The commerce benefited by the improvement is mainly lumber and salt, brought from the northern harbors by small steam barges and by sailing vessels. The passenger travel is steadily increasing.

July 1, 1907, balance unexpended	$84,983.27
June 30, 1908, amount expended during fiscal year for maintenance of improvement	5,518.76
July 1, 1908, balance unexpended	79,464.51
July 1, 1908, outstanding liabilities	159.73
July 1, 1908, balance available	79,304.78
July 1, 1908, amount covered by uncompleted contracts	4,885.50
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	75,000.00

(See Appendix L L 5.)

6. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Canal boat Pallas, in North Branch of Chicago River, near Kinzie street.*—Reported as an obstruction to navigation by vessel owners; was raised and then sunk in deep water in Lake Michigan at a total cost to the United States of $317.18.

(*b*) *Steam barge Atlas, in Main Branch of Chicago River, near Clark street.*—Reported as an obstruction to navigation; was destroyed and the débris removed from the river channel at a total cost to the United States of $4,134.96.

(*c*) *Barge No. 2 of Lake Michigan Car Ferry Transportation Company, in Lake Michigan at a point about 3 miles ENE. ¼ E. from Calumet Harbor breakwater light.*—Reported a serious obstruction to vessels; was removed at a total cost to the United States of $12,468.24.

(*d*) *Tug Macatawa, in Calumet River, near Chittenden Bridge.*—Abandoned by owners; was broken up, wreckage removed, at a total cost to the United States of $240.83.

(See Appendix L L 6.)

EXAMINATIONS AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and survey required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination with plan and estimate of cost of improvement of Calumet River, Illinois, with a view to obtaining a depth of 20 feet from One hundred and twenty-second street to its forks.—Reports dated November 11 and 25, 1907, are printed in House Document No. 349, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $78,000 is presented.

2. Preliminary examination and survey of harbor at Gary, Ind.—Reports dated November 16, 1907, and February 24, 1908, are printed in House Document No. 955, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $1,140,000 is presented.

The local officer was also charged with the duty of making a preliminary examination and survey of *Indiana Harbor, Indiana*, provided for in the river and harbor act of March 2, 1907, and report thereon will be duly submitted when received.

IMPROVEMENT OF RIVERS AND HARBORS IN THE SECOND CHICAGO, ILLINOIS, DISTRICT.

This district was in the charge of Maj. C. S. Riché, Corps of Engineers. Division engineer, Col. W. H. Bixby, Corps of Engineers, to February 15, 1908, and Lieut. Col. W. L. Fisk, Corps of Engineers, since that date.

1. Illinois River, Illinois.—(*a*) *Below Copperas Creek.*—The project, which contemplates the extension of slack-water improvement begun by the State of Illinois from Copperas Creek lock to the Mississippi River, and which includes the construction of two locks 350 feet long between sills, 75 feet width of chamber, with 7 feet of water over sills at low-water level of 1879, and dredging the channel where necessary to obtain 7 feet depth at low water, was adopted in 1880.

The lock and dam at Kampsville, Ill., 31 miles above the mouth of Illinois River, has been completed and in use since 1894, and that at La Grange, 79 miles above the mouth, since 1890.

The State of Illinois, aided by the United States, has executed part of the general project by the construction of locks and dams at Henry and at Copperas Creek, completing, except dredging, that part of the project between La Salle and the mouth of Copperas Creek, a distance of about 90 miles, over which section the State of Illinois collects tolls.

Harbor lines on both sides of the river at Peoria have been established.

The United States has expended on this work to June 30, 1908, $1,526,188.99, of which $10,468.22 was expended during the fiscal year in maintenance of plant and rebuilding same, care and repair of property and plant, snagging and supervision of the river.

The improvement of Illinois River has been in progress many years, and the present navigable depth has obtained at ordinary stages of the river for several years, during which freight rates in the vicinity have decreased to some extent; but as freight rates generally have diminished during these years, it is impossible to state whether the effect of river competition is shown in diminished railroad freight rates. The closing of the river to navigation, however, would unquestionably lead to a rise in freight rates on the adjacent railways, and as the volume of freight affected would be large, a good navigable condition should be maintained.

There are many wagon bridges and railroad bridges across the river, and at Peoria the troughs of large distilleries discharge into the channel; these structures have been modified from time to time to meet the demands of navigation.

It is proposed to apply the available funds and the appropriation recommended toward maintaining the navigable channel of 7 feet depth, removing snags, dredging, care and repair and rebuilding plant, and such local surveys as may be necessary from time to time.

July 1, 1907, balance unexpended		$70,952.44
Received from sales, etc.		244.10
		71,196.54
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$7,468.22	
For maintenace of improvement	3,000.00	
		10,468.22
July 1, 1908, balance unexpended		60,728.32
July 1, 1908, outstanding liabilities		1,000.00
July 1, 1908, balance available		59,728.32
Amount (estimated) required for completion of existing project		142,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(*b*) *From Copperas Creek to La Salle.*—The first appropriation for this section of the river was made March 2, 1907, and the approved project for its expenditure provides for securing the same navigable conditions from Copperas Creek to La Salle as are planned for the lower river, i. e., a channel depth of 7 feet at low water.

Operations have consisted in snagging, supervision, and repairs and additions to plant for dredging purposes; surveys have been made to locate shoal points and bars. The stage of water has been too high to render dredging either practicable or necessary. Work on this section of the river is to be carried on with the same plant used on the lower section.

The amount expended to June 30, 1908, is $8,392.74.

It is proposed to apply the available funds to securing and maintaining a navigable channel of 7 feet depth, snagging, care, and repair of property and plant, inspection and prevention of obstructions and encroachments, and such local surveys as may be necessary.

July 1, 1907, balance unexpended	$48,499.52
June 30, 1908, amount expended during fiscal year for works of improvement	6,892.26
July 1, 1908, balance unexpended	41,607.26
July 1, 1908, outstanding liabilities	500.00
July 1, 1908, balance available	41,107.26

(See Appendix M M 1.)

2. *Operating and care of La Grange and Kampsville locks, Illinois River, and approaches thereto.*—These locks and dams have been maintained and operated under the indefinite appropriation provided for in section 4 of the river and harbor act of July 5, 1884.

(*a*) *La Grange lock and dam.*—The river was open to navigation the entire year. From July 1 to 20, 1907, all boats passed through the lock; from July 21 to September 20 about one-third of the boats passed through the lock, and from September 21 to February 10 all boats passed over the dam. There was expended during the year $5,936.48.

(*b*) *Kampsville lock and dam.*—The river was open to navigation the entire year, but the lock was closed a short time in December, repairs being in progress. Rebuilding lock gates was undertaken and well advanced, being interrupted by high water. Mud was dredged from lock chamber and entrances. High water prevailed to the close of the fiscal year. There was expended during the fiscal year $7,378.08.

(See Appendix M M 2.)

3. Illinois and Mississippi Canal, Illinois.—The object of the improvement is to furnish a link in a navagable waterway from Lake Michigan to the Mississippi River at the mouth of Rock River, Illinois.

The canal has been located on the Rock Island route, approved by the Secretary of War October 27, 1888, as directed in the act of Congress of August 11, 1888. It proceeds from the Illinois River at its great bend, 1¾ miles above the town of Hennepin, Ill.; thence via Bureau Creek Valley and over the summit to Rock River at the mouth of Green River; thence by slack water in Rock River and a canal around the lower rapids of the river at Milan to the Mississippi River at the mouth of Rock River.

The canal is to be at least 80 feet wide at the water surface, 7 feet deep, and with locks 170 feet long and 35 feet width of lock chamber, capable of passing barges carrying 600 tons (maximum) freight.

A report upon the location, with detailed estimate of cost, of this canal was submitted June 21, 1890, and is printed in the Annual Report of the Chief of Engineers for 1890, page 2586.

The river and harbor act of September 19, 1890, made the first appropriation for the construction of the canal, and directed work to be begun by the construction of one of the locks and dams in Rock River.

In accordance with this act work was begun in July, 1892, near the mouth of Rock River, on the construction of a canal around the lower rapids of the river, and since that date has been prosecuted as rapidly as the appropriation of funds permitted. The survey work in locating the canal on the ground and proceedings for acquiring title to the right of way have been completed, and the canal has been definitely located on the ground throughout its entire extent.

The river and harbor act of March 3, 1905, authorizes the Secretary of War, in his discretion, to construct a fixed dam with movable crest in Rock River, in lieu of the lock and dam at or near Sterling, Ill., provided for by the approved project, the said dam with movable crest to be built from funds already appropriated or authorized for the construction of the canal and to constitute a part of the project for its construction.

The river and harbor act of June 3, 1896, placed the work under the continuing-contract system and limited the average amount of contract liability to be incurred in any one fiscal year to $400,000. There has been expended on this work to the close of the fiscal year ending June 30, 1908, $7,319,563.39.

The result of this expenditure has been:

First. The acquisition of the right of way for 4½ miles around the lower rapids of Rock River and the completion of 4½ miles of canal

there, involving the construction of 4½ miles of earthwork, 3 locks, 1 railroad and 2 highway swing bridges, 7 sluiceways and gates, 1 arch culvert, 2 dams 1,392 feet long across the arms of Rock River, 3 lock-keepers' houses, 1 small office building, a thorough riprapping of the canal banks (not included in the original estimates), and construction by contract of Moline wagon bridge, at a cost of $25,000, which was also not included in the original estimate.

Second. The acquisition of right of way for the main line and navigable feeder, completion of all railway and highway bridges, locks, culverts, aqueducts; execution of all earthwork and completion of dam and controlling works at head of feeder; erection of 14 houses and partial completion of 25 houses for overseers and lock tenders.

The canal was filled with water and formally opened to navigation October 24, 1907. Operating force has been organized and since January 1, 1908, the work has been maintained under the indefinite appropriation for operating and care of canals and other works of navigation, the completion of construction work progressing at the same time.

The entire work embraced in the original project for the canal, as modified by subsequent projects and plans as the work has progressed, may be summarized as follows:

Surveys and location upon the ground.
Acquisition of right of way and fencing.
Construction of—
- 95.8 miles of earthwork.
- 67 highway bridges.
- 1 farm bridge.
- 3 ponton bridges.
- 8 railroad bridges.
- 9 aqueducts.
- 62 culverts.
- 33 locks.
- 9 sluiceways and gates.
- 3 dams.
- 39 houses.
- Outlet to Rock River.
- New highway on mile 16.
- Improvement of 8.5 miles of Rock River.
- Moline wagon bridge (not in original estimate).

The work thus far completed may be summarized as follows:

Surveys and location upon the ground.
Acquisition of right of way and fencing.
Construction of—
- 95.8 miles of earthwork.
- 67 highway bridges.
- 1 farm bridge.
- 8 railroad bridges.
- 9 aqueducts.
- 62 culverts.
- 33 locks.
- 34 sluice gates.
- 3 dams.
- 14 houses and part of 25 additional.
- New highway on mile 16.
- Moline wagon bridge.
- 1 ponton bridge.
- Part of dredging in Rock River.
- Emergency gates, mile 23.

The work remaining to be done consists of completing 25 houses, dredging in Rock River, and miscellaneous work of revetment, bank protection, and finishing.

July 1, 1907, balance unexpended		$305,837.65
Received from sales, etc		3,792.15
		309,629.80
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$85,957.40	
For maintenance of improvement	44,909.22	
		130,866.62
July 1, 1908, balance unexpended		178,763.18
July 1, 1908, outstanding liabilities		2,500.00
July 1, 1908, balance available		176,263.18
July 1, 1908, amount covered by uncompleted contracts		15,300.00

(See Appendix M M 3.)

4. Operating and care of Illinois and Mississippi Canal.—This canal was formally opened to navigation October 24, 1907, and since January 1, 1908, has been maintained under the indefinite appropriation of July 5, 1884, for operating and care of canals and other works of navigation.

Work has consisted in organizing forces, patrolling banks, repairing and ditching, operating locks, maintaining and repairing structures, rebuilding telephone line, building barges, maintaining and operating boats, remedying seepage conditions, removing sediment and deposits, clearing débris, testing, seeding and revetting banks, and repairing breaks. Rules and regulations for the operation of the canal were approved by the Secretary of War April 8, 1908. Several leases have been made with private parties for tracts on the right of way for commercial purposes.

It is too early to predict what the character or amount of commerce on the canal will be, or what its effect upon freight rates will be. The section traversed is an agricultural country of great fertility and well developed, with many and various manufacturing interests of moderate size in the adjacent territory. The effect upon freight rates which was hoped for from this canal when it was projected eighteen years ago has been largely realized from other causes, among which competition among railroads and larger train loads may be mentioned.

There has been expended on this work from January 1, 1908, to June 30, 1908, the sum of $86,005.92, exclusive of $2,200 outstanding liabilities June 30, 1908.

(See Appendix M M 4.)

IMPROVEMENT OF RIVERS AND HARBORS IN THE GRAND RAPIDS, MICHIGAN, DISTRICT.

This district was in the charge of Col. M. B. Adams, Corps of Engineers, to December 6, 1907, in the temporary charge of Maj. Charles Keller, Corps of Engineers, from December 6, 1907, to February 1, 1908, and in the charge of Colonel Adams since February 1, 1908. Division engineer, Col. G. J. Lydecker, Corps of Engineers, to November 15, 1907.

General statement as to the usual variations in the level of the lake surface at all the harbors on the eastern shore of Lake Michigan.—The level of the lake surface varies considerably from time to time. At present its highest stage may be stated as about mean low water, and obtains from the end of June to the middle of August. Its lowest stage is between 1.5 and 2 feet below mean low water, and obtains with slight change from early in November to early in April. All depths at the various harbors in this report refer to zero of gauge, which is 581.63 feet above mean tide at New York.

1. St. Joseph Harbor and River, Michigan.—These were formerly carried as separate works, but are now combined in consequence of a provision in the river and harbor act of June 13, 1902.

(*a*) *St. Joseph Harbor.*—This harbor is formed by the junction of the St. Joseph and Pawpaw rivers and extends along the city front of St. Joseph, and in its original condition had a natural width of 800 feet, which has been reduced to 300 feet by wharves built upon the approved harbor lines. It has been under improvement by the United States since 1836, previous to which time there was a narrow and crooked channel with depths which varied from 3 to 7 feet. The original project of 1836 is not clearly known. Up to 1866 there were built 1,100 feet of north pier and 212 feet of south pier, which protected a cut through the narrow tongue of land to the north of the old river mouth, the width between the piers being 240 feet, which became 257 feet through subsequent repairs. In all, $162,113 was expended upon this work. In 1866 the first definitely known project was adopted, and this proposed the extension of the south pier 200 feet for the purpose of facilitating the creation of a direct channel of 16 feet depth through the bar at the entrance. The project of 1866 was modified in 1874, 1875, 1880, and 1892, the changes having reference principally to the length and direction of the two piers. The Benton Harbor Canal, which is about 1 mile long and extends from the upper part of the harbor to the town of Benton Harbor, was taken over by the United States for the purpose of care, maintenance, and improvement in 1880. In all, there was expended upon these various projects $503,113.23.

The river and harbor act of March 3, 1899, adopted the present project, which is printed in the Annual Report of the Chief of Engineers for 1898, pages 2496–2498. This project provides for an entrance channel 18 feet deep and for an interior channel 18 feet deep and 150 feet wide along the city front of St. Joseph, while the Benton Harbor Canal and the turning basin at the mouth of the St. Joseph River are to be dredged to 15 feet, the north pier to be extended 1,000 feet, and the south pier, upon a line parallel with the north pier, 1,800 feet. The width between is 330 feet at the entrance, narrowing to 257 feet inside. The estimated cost of completion of the existing project was given in the above report at $380,000.

Up to June 30, 1908, there had been expended upon the existing project $364,297.88, of which $61,204.50 was applied to maintenance. Operations since June 25, 1900, have been in progress for the purpose of completing all the work contemplated. As a result of the above expenditures, 1,000 feet has been added to the north pier and 1,800 feet to the south pier, and in November, 1901, the proposed dredging had been completed so far as practicable. Deterioration in the dredged channels has since taken place. The bar just beyond the ends of the

piers still persists and formerly the maximum through draft was limited to 16.6 feet. Since 1907, however, when the channel through the outer bar was dredged to 20 feet, so as to provide an 18-foot depth during storms, it has maintained that depth unusually well; nothing less than 19 feet in depth was found on the bar at the survey, April 2–8, 1908. Dredging through this bar will have to be done from time to time, and annual dredging will be required for maintenance inside.

The north pier and revetment measure 2,854 feet, 2,183.5 feet being crib work and 670.5 feet pile work. At the east end a wing 165 feet long connects it with the dock of the United States light-house depot. The south pier is 2,623 feet long, 1,800 feet being crib work and 820 feet pile work. These structures are in fair condition, except the 165 feet of wing at east end of north pier; and minor repairs, decking, stone filling, and sheet piling are needed.

All new construction work under the authorized project has been completed, and the existing works on the entrance channel are in serviceable condition.

During the year the channel to shore line between the piers was deepened to 20 feet, thence to the Benton Harbor Canal to 18 feet, the width of the dredged channel being about 150 feet. Of the balance on hand it is proposed to reserve $1,500 as part payment for an inspection steamer and to expend the remainder in dredging and repairs of piers, including stone filling for the piers. It is expected to expend the additional money asked for in repairs as required and in two years' dredging operations.

Deterioration of depth is due to sand brought down by the St. Joseph and Pawpaw rivers during floods, and as this is a matter of annual recurrence dredging for the restoration of the channel may be expected to be required from year to year. An emergency contract had to be made last spring owing to the shoaling of the channel at the mouth of the Pawpaw River in order to render the channel navigable.

The principal traffic benefited by this improvement is the fruit traffic and the carrying of passengers, including excursionists, to the summer resorts in this vicinity. Both classes of traffic show continuous growth. The entire traffic is served by a single line of steamers, which, however, during the summer runs from two to four boats daily, some of these being of very great size.

House Document No. 307, Fifty-fifth Congress, second session, reproduces a map accompanying the present revised project, which is not republished in the Annual Report of the Chief of Engineers for 1898.

(*b*) *St. Joseph River.*—This is a crooked stream, obstructed by numerous shoals, with depth in channel crossings of from 24 to 30 inches. The intervening pools are generally from 4 to 8 feet deep. The part under improvement is from the mouth at St. Joseph to Berrien Springs, a distance of about 25 miles by river. The improvement of this section to make a low-water channel 3 feet deep has been in progress since 1889, and consists in removing snags and logs and closing secondary channels, or concentrating the flow at other critical points by dams of brush, logs, and stone.

The amount expended to June 30, 1908, was $6,246.26, of which $4,555.49 was for construction and $1,690.77 for maintenance, as a

result of which many of the worst places of the stream had been improved to the required extent.

Operations on the St. Joseph River usually comprise a small amount of wing-dam construction, the removal of overhanging trees and snags by a force of hired laborers; no work was done on this river during the past year and inquiry from interested parties failed to elicit the necessity for any. No appropriation is asked for improvement, as the funds on hand are believed to be sufficient for the next two years' operations.

The average annual expenditure has been $500.

The traffic benefited by this improvement is a limited one, three small steamers being employed to carry passengers (almost exclusively summer tourists) and a small quantity of freight, which is principally fruit.

The money on hand will be expended in maintenance and contingencies.

The effect of the improvement on freight rates can not be stated.

Entrances and clearances.

ST. JOSEPH HARBOR.

Calendar year.	Number.	Tonnage.
1906	1,823	926,976
1907	1,082	809,879

Total freight carried, calendar year—

1906	tons	115,839
1907	do	78,044

ST. JOSEPH RIVER.

Total freight carried, calendar year—

1906	tons	2,034
1907	do	355

Passengers carried in—

1906	20,372
1907	5,952

ST. JOSEPH HARBOR.

July 1, 1907, balance unexpended	$27,543.07
June 30, 1908, amount expended during fiscal year for maintenance of improvement	5,614.33
July 1, 1908, balance unexpended	21,928.74
July 1, 1908, outstanding liabilities	180.00
July 1, 1908, balance available	21,748.74
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	15,000.00

ST. JOSEPH RIVER.

July 1, 1907, balance unexpended	$1,003.74
July 1, 1908, balance unexpended	1,003.74

CONSOLIDATED.

July 1, 1907, balance unexpended	$28,546.81
June 30, 1908, amount expended during fiscal year for maintenance of improvement	5,614.33
July 1, 1908, balance unexpended	22,932.48
July 1, 1908, outstanding liabilities	180.00
July 1, 1908, balance available	22,752.48
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	15,000.00

(See Appendix N N 1.)

2. *South Haven Harbor, Michigan.*—This harbor is situated at the mouth of Black River. Improvements were begun in 1867, at which time there existed a channel 7 feet deep and 85 feet wide between slab piers. These piers had been built by residents of the vicinity, at a cost of about $18,000. The banks of the river for 500 feet on each side had a rough protection of close piling.

The project of 1866, as modified in 1869, 1872, and 1888, provided for constructing parallel piers and revetments 175 feet apart at the mouth of Black River, with the object of procuring a channel 12 feet deep and extending the navigable channel one-half mile up Black River to the highway bridge by dredging.

The act approved March 3, 1905, adopted a project for pier extension and dredging to a depth of 16 feet, at an estimated cost of $279,370, and $10,000 annually for maintenance. (See H. Doc. No. 119, 58th Cong., 2d sess.) The law provided, however, that none of the $50,000 appropriated for the improvement should be used, except for maintenance of existing channels, until proper dock lines had been established and suitable bulkheads built along these lines by the city of South Haven or by the riparian owners, and the property lying on the channel side of these dock lines had been deeded to the United States free of cost.

By joint resolution of Congress approved June 29, 1906, $10,000 of the appropriation of March 3, 1905, was made immediately available to afford a 16-foot depth in the channel, which was expended prior to June 30, 1907.

The act of March 2, 1907, appropriated $40,000 for this harbor, subject to restrictions similar to those imposed by the act of 1905.

Unless the conditions precedent to the expenditure of the appropriations, March 3, 1905, and March 2, 1907, are complied with, further operations will be restricted to maintenance of a 12-foot channel. Owing, however, to the possibility of one or more of the riparian owners at the inner ends of the Government piers complying with the prescribed conditions, it is proposed to maintain a channel depth of 16 feet between the piers and 18 feet over the outer bar, so that the requirements of the act of March 2, 1907, on the Government's part may be complied with immediately when such riparian owners have met the requirements of the law on their part.

The notice of Congress is particularly invited to the above interpretation of the law and the proposed action thereunder, inasmuch as

considerable pressure has been exercised recently to cause a different interpretation to be put upon the law by the executive department of the Government and to bring about a deepening of the channel to greater depths than 12 feet where no harbor lines have been established.

The total expenditure to June 30, 1908, was $346,310.58, of which $187,253.08 was expended for construction and $159,057.50 for maintenance.

The works are in the condition described in the Annual Report of the Chief of Engineers for 1901, page 3085, except for the additional deterioration due to the lapse of seven years. The channel depth exceeds that authorized under the old project.

As is the case with most of the harbors in this vicinity, the principal traffic of South Haven depends upon the fruit crops and the summer resort and excursion travel from Chicago. The business of the harbor has been increasing rapidly.

The money on hand will be expended on maintenance and contingencies until the conditions allowing the continuance of improvement are complied with, and as appropriated will be applied in like manner.

The project is reported to have a material influence in reducing freight rates.

Entrances and clearances.

Calendar year.	Number.	Tonnage.
1906	683	602,358
1907	609	484,852

Freight carried during calendar year—		
1906	tons	60,077
1907	do	41,483
Passengers carried during season of—		
1906		279,886
1907		181,594
July 1, 1907, balance unexpended		$75,925.14
June 30, 1908, amount expended during fiscal year for maintenance of improvement		12,798.25
July 1, 1908, balance unexpended		63,126.89
July 1, 1908, outstanding liabilities		2,420.00
July 1, 1908, balance available		60,706.89
Amount (estimated) required for completion of existing project		248,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		89,000.00

(See Appendix N N 2.)

3. Harbor at Saugatuck, and Kalamazoo River, Michigan.—Before the work of improvement was begun by the United States, in 1869, this harbor, which is at the mouth of Kalamazoo River, had been improved by local enterprise by the construction of slab piers 200 feet apart, the north pier being 500 feet long and the south pier 1,575 feet. The channel depth varied from 5 to 7 feet. The present proj-

ect for the old harbor at the mouth of the river was adopted in 1867 and amended in 1869, 1875, and 1882. To June 30, 1906, $207,785.92 had been expended, of which $90,231.99 was for construction and $117,553.93 for maintenance, and as no further expenditures will be made on old harbor, the balance unexpended July 1, 1906, $9,453.08, was diverted to improvement of new harbor. At the old harbor there is a north pier 715 feet long, which is entirely unserviceable; separated from the pier by a long stretch of unprotected bank there is a north revetment, partly destroyed and partly covered by sand. The south pier is 3,863 feet long and is practically ruined. Frequent dredging has been required for maintenance of an 8-foot channel, which rapidly deteriorates. Appropriations since 1882 have been too small to keep the piers in proper repair.

The usual provision for maintenance at the old harbor by dredging was not made in 1906; inasmuch as the improvement at the new harbor under the existing project was sufficiently advanced to be assured that it could be made available in time for the season's traffic, operations there were pressed forward vigorously.

Persons locally interested had urged the opening of the new channel prior to the revetting of the banks within the piers that had only been built to points about 100 feet shoreward of the shore line; the barrier that separated Kalamazoo River from Lake Michigan was therefore allowed to be cut away and this channel was rendered available to commerce June 30, 1906. The new channel was then deepened by the U. S. dredge *General Gillespie* to 16 feet, with a view to continued maintenance by this means; but a storm on October 9 breached the barriers of low beach sand around the inner ends of both piers and carried so much sand into the channel as to preclude further operations. In anticipation of some such occurrence, allotments amounting to $14,700 had been granted from the emergency appropriations June 13, 1902, and March 3, 1905, to extend the piers shoreward; the contract could only be placed, however, August 17, 1906, and the work commenced September 14, 1906, and had not progressed far enough when the storm of October 9 occurred to have effected any additional protection. It has been found necessary to repair the pile pier in places and to strengthen it with filling and riprap stone. These matters are explained more in detail in the report of the district officer, Appendix N N 3 of the Annual Report of the Chief of Engineers for 1907.

The existing project for the new harbor was adopted by the river and harbor act of June 3, 1896. It provides for creating a channel of 12 feet depth and navigable width by dredging the river for a distance of 1¾ miles below Saugatuck, and thence making a new cut from the river to the lake, entering the latter about 3,700 feet below the present mouth at the Saugatuck piers. The original estimate for the work was $150,000, but authority was granted on May 31, 1900, to increase this to $250,000. The river and harbor act of March 2, 1907, authorized the maintenance of a harbor channel of sufficient depth to allow the free use of the Government dredge *General Gillespie*, viz. 16 feet.

To June 30, 1908, $251,112.96 had been expended, $227,560.55 for construction and $23,552.41 for maintenance.

A contract was made for revetment of the banks along the cut between the river and the lake; operations commenced July 29, 1907,

and were completed June 19, 1908, at a cost of $59,088.55, including contingencies.

The completion of the bank revetment allowed dredging of the channel to be undertaken with fair prospects that sudden storms would not again close it; consequently bids were at once invited, to be opened July 2, 1908, for dredging 45,000 cubic yards from the bar and from between piers and revetments so as to allow the U. S. dredge *Gillespie* to operate and widen and deepen the channel. These operations will practically exhaust the available funds.

The harbor is near a very prosperous fruit region, and the fruit traffic has been its principal source of business. Saugatuck is but 8 miles south of Holland, with which it is now connected by a trolley road, and about 17 miles north of South Haven. Holland and South Haven both command other sources of business than the fruit traffic alone, and bid fair to increase in importance through the fact that they are termini of important railroad lines.

The Annual Report of the Chief of Engineers for 1896, pages 2741–2743, and House Document No. 192, Fifty-fourth Congress, first session, contain in full the report pertaining to the adopted project for the proposed change in the location of this harbor. The House document contains also a map of the locality.

The money on hand will be expended in maintenance and contingencies.

It is reported that as yet the project has had no effect on freight rates, but that reduced charges may be expected upon completion of the improvement.

Entrances and clearances.

Calendar year.	Number.	Tonnage.
1906	988	154,628
1907	284	16,546

Total freight carried, calendar year—		
1906	tons	21,500
1907	do	5,690
July 1, 1907, balance unexpended		$94,184.33
Refundment of overpayment		.05
		94,184.38
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$56,612.44	
For maintenance of improvement	14,531.77	
		71,144.21
July 1, 1908, balance unexpended		23,040.17
July 1, 1908, outstanding liabilities		102.00
July 1, 1908, balance available		22,938.17
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix N N 3.)

4. Holland Harbor, Michigan.—When improvement was begun in August, 1867, by the United States there existed a narrow channel 5½

feet deep between piers built of brush and of irregular cribs. These had been constructed by the harbor commissioners of the adjoining town of Holland.

A project was adopted in 1867 and amended in 1873, 1879, 1884, and 1892. From 1867 to 1880 there were built by the United States piers and revetments aggregating 1,854 feet on the north side and 1,691 feet on the south side. Since the latter date there have been no additions to these structures, which were designed to create a 12-foot channel varying in width from 160 feet inside to 213 feet outside, except, in 1889, a length of 160 feet of pile pier on the south side, designed to close a gap in the existing structure. Upon this project there was expended up to March 3, 1899, $304,217.30, of which $127,597.50 was for maintenance. Repairs made during recent years have diminished the width inside to 148 feet, but repairs now being made will widen the channel at its narrowest place from 148 to 198 feet.

A revised project was adopted in the river and harbor act of March 3, 1899, and provided for securing a channel 16 feet deep, protected by piers and revetments 148 feet to 250 feet apart, the estimated cost of completion being $240,000.

The river and harbor act of March 3, 1905, appropriated $65,000 and authorized continuing contracts for $110,000 additional (which has been appropriated), with a proviso that the United States engineer in charge might, subject to the approval of the Chief of Engineers, modify the existing project by the widening of the harbor entrance, and an additional appropriation of $138,452 was made for the work by the act of March 2, 1907.

A drawing and description of the plan adopted to carry this proviso into effect may be found in the report of the district officer (pp. 2176–2177, Annual Report of Chief of Engineers for 1905).

A contract was made for the completion of the entire improvement for $175,578.96. Operations commenced April 16, 1906, and are now in progress. The work may be said to be progressing satisfactorily and to have already demonstrated its efficiency.

From March 3, 1899, the date of adoption, to June 30, 1908, there was expended on this project and its modifications $266,545.93, of which $95,631.99 was for maintenance.

Considerable injury to the north entrance pier and revetment near shore line and to the end of the north pier was caused by severe storms in the autumn of 1905, as related at length in the report of the district officer, Appendix N N 5 of the Annual Report of the Chief of Engineers for 1906.

A contract for repairs to the injured north pier that will also widen the channel from 148 to 198 feet has been made, and the work is approaching completion.

A contract for general repairs to the south pier has been made and operations are about to commence with the expectation of completion December 31, 1908.

Dredging at the harbor was carried on September 14–18 and September 26 to October 1, also December 13–28, 1907, and March 18 to April 7, 1908. A channel of 17 feet in depth was maintained, notwithstanding the amounts of sand carried through the injured piers; there was 59,205 cubic yards removed in these operations.

Entrances and clearances.

Calendar year.	Number.	Tonnage.
1906	1,490	1,862,938
1907	1,472	1,968,143

Total freight carried, calendar year—		
1906	tons	414,728
1907	do	488,398
July 1, 1907, balance unexpended		$71,627.81
June 30, 1908, amount expended during fiscal year for maintenance of improvement		2,609.01
July 1, 1908, balance unexpended		69,018.80
July 1, 1908, outstanding liabilities		101.00
July 1, 1908, balance available		68,917.80
Amount (estimated) required for completion of existing project		40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		190,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix N N 5.)

6. Grand River, Michigan.—Before any work of improvement was done upon this stream the depth in the crossings over some of the bars did not exceed 2 feet.

Between 1881 and 1886 the sum of $50,000 was expended in securing, by dredging, narrow channels through these bars with a depth of about 4 feet. No further work was done until 1896, but even then, at the expiration of over ten years, traces of the dredged cuts were still apparent.

The former project, upon which work was begun in May, 1897, was adopted by the river and harbor act of June 3, 1896, and is based upon a report upon examination and survey reprinted in Annual Report of the Chief of Engineers for 1892, pages 2369 to 2395. The project contemplated dredging a channel a distance of 38 miles from Grand Haven to Grand Rapids, with a depth of 10 feet and a width of 100 feet. The project also proposes the use of contraction works wherever necessary to increase the effect of the dredging or to render it more permanent.

The original estimated cost of project adopted in 1896 was $670,500; but the project may be said to have been modified by act of June 13, 1902, and the cost increased to not less than $774,000.

The act of March 3, 1905, modified the former project by adopting the report submitted in House Document No. 216, Fifty-eighth Congress, second session, and by providing that no portion of the money appropriated shall be used in providing a turning basin in the city of Grand Rapids.

The report referred to above recommends, on pages 4 and 5, that a channel of 6 feet depth and 100 feet width be adopted for the improvement. The estimate in the report for a 6 foot channel 100 feet wide from Fulton street, in Grand Rapids, to Grand Haven, Mich.,

In 1857 the Detroit and Milwaukee Railroad Company (Grand Trunk), whose western terminus is at the town of Grand Haven, built a pile pier 3,185 feet long upon the south side of the entrance, and also revetted, by means of close piles, portions of the bank upon the north side of the river. In 1866, when work by the United States was begun, the pile pier had been partly destroyed by fire and by storms. The available depth was 13 feet.

The present project was adopted in 1866 and amended in 1868, 1880, 1890, and 1892. It provides for the construction of parallel piers and revetments 400 feet apart, with the object of creating an entrance channel 18 feet deep. Estimated cost was $804,366.15. The amendments to the original project did not materially change its original purpose, the changes being principally in the proposed length of the piers and revetments.

To June 30, 1908, there had been expended upon the existing project the sum of $855,924.27, of which $542,976.82 was for construction and $312,947.45 for maintenance.

The result of the above expenditure was the construction and maintenance of 3,538 linear feet of north pier and 5,774 linear feet of south pier, with a channel of variable depth between them maintained by occasional dredging. The piers are in need of leveling and repairs, and considerable of this work is now in progress.

Dredging by the U. S. dredge *Gillespie* was carried on September 16 to October 5, 1907, and January 2–3, 1908, and there was 19,289 cubic yards removed, so that the soundings June 4–6, 1908, showed a depth on the outer bar of 19 feet and between piers a least available depth of 20 feet.

A central bar persists in forming from year to year beyond the entrance to this fine harbor and seriously impairs its usefulness, even when there is no extraordinary freshet in Grand River; consequently it is fortunate that there is a dredge at hand to undertake relief at any time.

The sum of $4,300 from the available balance will be reserved for partial payment on an inspection steamer, and the remaining sum will be devoted to repairs and other maintenance.

In order to complete the project 250 feet of pier extensions are required at an estimated cost of $40,000.

The district officer invites attention to the necessity for dredging the channels in the inner harbor so as to carry the 16-foot depth in the river to the city limits and into Spring Lake.

If the general deepening of the channels of this important harbor is authorized by law, as at other harbors, a provision of $40,000 should be made for the purpose.

This harbor has for years been one of considerable importance. It is the western terminus of the Detroit, Grand Haven and Milwaukee branch of the Grand Trunk Railroad, in connection with which is run throughout the year a line of steamers to Milwaukee. In addition there are two lines with regular and frequent scheduled trips to Chicago. All three lines do a large passenger and a very considerable freight business, especially during the season of fair weather.

The latest map of this harbor is found in the Annual Report of the Chief of Engineers for 1890, page 2650.

The effect of the project on freight rates could not be ascertained.

Entrances and clearances.

Calendar year.	Number.	Tonnage.
1906	1,490	1,842,938
1907	1,472	1,963,143

Total freight carried, calendar year—

1906	tons	414,728
1907	do	488,398

July 1, 1907, balance unexpended	$71,627.81
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,609.01
July 1, 1908, balance unexpended	69,018.80
July 1, 1908, outstanding liabilities	101.00
July 1, 1908, balance available	68,917.80
Amount (estimated) required for completion of existing project	40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	190,000.00

(See Appendix N N 5.)

6. Grand River, Michigan.—Before any work of improvement was done upon this stream the depth in the crossings over some of the bars did not exceed 2 feet.

Between 1881 and 1886 the sum of $50,000 was expended in securing, by dredging, narrow channels through these bars with a depth of about 4 feet. No further work was done until 1896, but even then, at the expiration of over ten years, traces of the dredged cuts were still apparent.

The former project, upon which work was begun in May, 1897, was adopted by the river and harbor act of June 3, 1896, and is based upon a report upon examination and survey reprinted in Annual Report of the Chief of Engineers for 1892, pages 2369 to 2395. The project contemplated dredging a channel a distance of 38 miles from Grand Haven to Grand Rapids, with a depth of 10 feet and a width of 100 feet. The project also proposes the use of contraction works wherever necessary to increase the effect of the dredging or to render it more permanent.

The original estimated cost of project adopted in 1896 was $670,500; but the project may be said to have been modified by act of June 13, 1902, and the cost increased to not less than $774,000.

The act of March 3, 1905, modified the former project by adopting the report submitted in House Document No. 216, Fifty-eighth Congress, second session, and by providing that no portion of the money appropriated shall be used in providing a turning basin in the city of Grand Rapids.

The report referred to above recommends, on pages 4 and 5, that a channel of 6 feet depth and 100 feet width be adopted for the improvement. The estimate in the report for a 6-foot channel 100 feet wide from Fulton street, in Grand Rapids, to Grand Haven, Mich.,

prepared from data furnished by the district officer, is $430,000, including available plant and funds.

To June 30, 1908, the sum of $395,051.51 had been expended in dredging 2,364,245 cubic yards of sand, clay, cobblestones, etc., in building 132,625 linear feet of training walls, and in the purchase and maintenance of plant. This sum includes $30,369.13 expended for maintenance of contraction works and $2,668.15 for maintenance of completed 6-foot channel.

Operations during the year have been the extension of the channel of navigable width and 6 feet depth to Fulton Street Bridge, Grand Rapids, Mich., the dredging through other shoals between Wealthy avenue and Bass River by the Government plant, the construction and repair of contraction works, as required, the usual survey work, and rebuilding and repair of plant.

The difficulty of disposing of material dredged by the dipper dredge *Farquhar* made it necessary to provide a conveyor to operate in connection with this dredge, which was accomplished by the conversion of the old dredge *Saginaw* into a conveyor.

The available depths a year ago were stated as follows:

Between Grand Rapids and the mouth of Bass River there is a navigable channel (in some cases only the width of a single dredged cut) with the following depths at extreme low water: For about 18.8 miles, 6 feet; 3.2 miles, 5 to 6 feet; 1.4 miles, less than 5 feet. The Grand River Boat Line reported last year a least depth between Bass River and Grand Haven of 5 feet. At the present time the available depths may be stated thus: Between Grand Rapids and the mouth of Bass River there is a navigable channel (in one short stretch of about 100 feet only the width of a single dredged cut) with the following depths at extreme low water: For about 21.1 miles, 6 feet; 1.5 miles, 5 to 6 feet; 0.8 mile, less than 5 feet.

The contraction works are in fairly good condition. With material on hand it is proposed to repair old walls where needed.

The project is naturally one of constant repair and maintenance. High water ordinarily occurs in the early spring, and is from 12 to 18 feet above low water in the neighborhood of Grand Rapids. In the lower part of the river the difference between the high and low stages becomes less, and at the mouth it is inconsiderable.

The commerce involved must be stated as insignificant. A boat line of two new boats (each 219 tonnage and 700 passenger allowance), called the Grand Rapids and Lake Michigan Transportation Company, was put in operation two years ago between Grand Rapids and Grand Haven. It provided new warehouse facilities at the foot of Fulton street for the reception and handling of freight, but failed to find business, and the boats have been sold and removed from the river, and the warehouse is in a condition of disuse. The average daily loads of these boats when in commission was stated at 49 tons freight and 77 passengers.

It is expected to expend the money on hand and as appropriated in continuing improvement and in maintenance.

Definite information as to the effect of the project on freight rates could not be ascertained.

Freight carried, calendar year 1906, 110,395 tons; 1907, 88,653 tons.

Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 715 of this report.

July 1, 1907, balance unexpended		$99,867.89
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$23,758.66	
For maintenance of improvement	7,784.59	
		31,543.25
July 1, 1908, balance unexpended		68,324.64
July 1, 1908, outstanding liabilities		3,039.00
July 1, 1908, balance available		65,285.64
Amount (estimated) required for completion of existing project		149,000.00

(See Appendix N N 6.)

7. *Muskegon Harbor, Michigan.*—This harbor is the outlet of Muskegon River, one of the largest in Michigan, which before emptying into Lake Michigan expands into Muskegon Lake. The channel between the lakes in 1867, before operations were begun by the United States, was 3,000 feet long and about 12 feet deep, except at the entrance, where the depth was 11 feet and the channel fluctuating. By private enterprise the entrance had been protected by converging slab piers.

The present project was adopted in 1866 and amended in 1869, 1873, 1881, 1884, 1890, 1892, and 1902. In its final form it provides for a through channel 20 feet deep and 300 feet wide, protected by piers and revetments. Estimated cost of completion of revised project of 1902, $380,000. The various changes in the original project did not modify it essentially. They refer merely to the depth of the channel and to the width, length, and direction of the piers.

To June 30, 1902, there was expended upon former modifications of the project the sum of $526,293.36, of which $388,218.42 was for construction and $138,074.94 for maintenance. As a result of the above expenditure there had been constructed a north pier and revetment 2,780 feet long and a south pier and revetment 4,402 feet long, protecting a channel whose width varies from 308 feet at the entrance to 167 feet inside, while the maximum depth which on June 30, 1908, could be carried over the shoalest point in the channel was 16.5 feet.

From July 1, 1902, to June 30, 1908, there was expended upon the project approved June 13, 1902, the sum of $163,079.99, of which $94,506.01 was for construction and $68,573.98 for maintenance.

Dredging was done between the piers and on the outer bar during the year by the U. S. dredge *Gillespie*. The dredge operated January 8 and 18–22, also May 21–25, 1908, and removed a total of 15,328 cubic yards. Soundings made May 27 to June 1, 1908, showed an available depth of 21 feet over the outer bar and 16.5 feet between the piers.

A contract was made October 25, 1905, for removing 328 linear feet of cribwork from the portion of the north pier that converges toward the south pier and for replacing it on a line in extension of the north pier parallel to and 300 feet distant from the south pier; for extending this cribwork 1,672 feet toward Muskegon Lake with sheet-pile revetment, and for building 310 linear feet of sheet-pile revetment, station 13+20 to station 16+30, of the south channel protection. Operations commenced April 17, 1906, and were completed July 6, 1907.

The contract for repairing 628 linear feet of the south pier was completed June 30, 1908.

A contract has been made for dredging the channel to the full width where the new revetment is built; operations were commenced May 4, 1908, and are in progress, the work to be completed September 1, 1908.

A contract has been made for the construction of 1,200 feet of the sheet-pile revetment on the north side of the channel; work is in progress and is to be completed September 30, 1908.

There are 350 linear feet at the outer end of the north pier that are 23 to 26 years old and in need of general repairs; the rest of the piers are in good condition with the exception of places injured by colliding vessels.

The funds that were on hand and made available by act of March 2, 1907, are being applied on the above contract operations, and the present available balance is expected to be applied in repairs to 350 feet of old pier and to dredging operations, maintenance, and contingencies.

The completion of the project will require 550 feet of pier extension, the remainder of the dredging in the channel between the piers so as to afford 300 feet width and 20 feet depth and the extension of the revetments on the north side of the channel 1,100 feet to Muskegon Lake, estimated to cost $154,750.

During the season of navigation two lines of steamers regularly use this harbor, which is a terminus of three important railroad lines. Their business is a substantial one, and with increased facilities should grow considerably. A general freight and passenger business is done, and in the summer months is largely augmented by the fruit and the resort traffic. Muskegon Lake itself is a magnificent harbor, 5 miles long and about 1½ miles wide, with depths varying from 30 to 40 feet. If readily accessible, this would be an excellent harbor of refuge.

The Annual Report of the Chief of Engineers for 1901, pages 3131–3134, and House Document No. 104, Fifty-sixth Congress, second session, contain in full a report upon a preliminary examination of this harbor, in which it is estimated that to secure a channel 300 feet wide and 20 feet deep will cost $380,000. This project was adopted by the river and harbor act of June 13, 1902. A map showing the harbor and the outlines of the above project accompanies the document mentioned.

It is reported that the project has had a marked influence in providing transportation facilities for commodities at reduced rates.

Entrances and clearances.

Calendar year.	Number.	Tonnage.
1906	907	593,034
1907	820	532,807

Total freight carried, calendar year—

1906	tons	136,340
1907	do	120,194

July 1, 1907, balance unexpended		$128,787.43
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$13,225.24	
For maintenance of improvement	25,325.54	
		38,550.78
July 1, 1908, balance unexpended		90,236.65
July 1, 1908, outstanding liabilities		665.00
July 1, 1908, balance available		89,571.65
July 1, 1908, amount covered by uncompleted contracts		59,508.16
Amount (estimated) required for completion of existing project		154,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		154,750.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix N N 7.)

8. *White Lake and Pentwater harbors, Michigan.*—These harbors were formerly carried as separate works, but are now consolidated in consequence of a provision in the river and harbor act of June 13, 1902.

(*a*) *White Lake Harbor.*—When the present project was adopted, the natural outlet of White Lake, about 3,550 feet north of the present entrance, afforded a channel 5 feet deep and 125 feet wide between slab piers built by local enterprise.

The approved project provided for the abandonment of the old outlet and the creation of a new one, 12 feet deep and 200 feet wide between piers and revetments. This project was adopted in 1866, amended in 1873, 1884, and 1892, the present amended estimated cost being $353,550. The various amendments to the original project have not altered it materially, as they relate principally to the length of the proposed piers and revetments. The provision in the act approved March 2, 1907, that "the Secretary of War is authorized to dredge the channel at Pentwater to the depth of 16 feet and to dredge the channel at White Lake to sufficient depth to allow the free use of the Government dredge *Gillespie*," may be said to have changed the project to a 16-foot depth and 200 feet width between piers and revetments.

There are 1,448 feet of south pier and 1,231 feet of north pier that are sadly in need of repairs, at an estimated cost of $67,000, and the annual dredging of the harbor if the piers are extended is estimated at $2,500.

The cost of annual dredging required at this harbor to maintain a 16-foot channel would probably be reduced to $2,500 or less if these improvements were made and if the dredging was done by the *Gillespie;* whereas it will be very difficult to maintain such a channel in any other way, and certainly at a greatly increased cost.

To June 30, 1908, there was expended upon the existing project the sum of $349,982.29, of which $207,862.44 was for construction and $142,119.85 for maintenance. This expenditure procured the construction and maintenance of a north pier and revetment 1,715 feet long and a south pier and revetment 1,953 feet long, the natural depth of the channel between them being about 10 feet. Periodical

dredging is necessary to secure and maintain a 16-foot channel. Up to June 30, 1908, the maximum draft that could be carried over the shoalest point of the channel was 16 feet.

The U. S. dredge *Gillespie* operated at this harbor July 26 to August 19, 1907, and May 2–20, 1908, and removed 68,873 cubic yards.

Soundings made April 20–22, 1908, showed an available depth of 15 feet, which was increased to 16 feet by the May dredging.

The funds available are to be used in payment for stone filling to portions of the piers and to cover the cost of another period of dredging by the *Gillespie*.

The harbor is but 10.5 miles north of Muskegon. Such traffic as there is hardly exceeds in value the annual expenditure necessary to maintain a reliable 16-foot channel.

The last published map of the locality is contained in the Annual Report of the Chief of Engineers for 1884, page 1982.

(*b*) *Pentwater Harbor.*—Before work was begun at this harbor by the United States there existed an irregular channel 4 feet deep and 75 feet wide between slab piers built by local enterprise.

The existing project, adopted in 1867 and amended in 1873, 1884, and 1892, provides for widening the old entrance to 150 feet and deepening it to 12 feet, the sides being protected by piers and revetments. Estimated cost was $327,713.40. The amendments to the original project relate merely to the length of the proposed piers and revetments and in no wise enlarge its original scope. The present project, by reason of the provision in the act of March 2, 1907, provides for a channel 16 feet deep and about 150 feet wide, protected by suitable piers and revetments.

To June 30, 1908, there was expended the sum of $312,464.69, of which $179,899.10 was for construction and $132,565.59 for maintenance. The result was a channel 140 to 153 feet wide, whose natural depth is from 9 to 10 feet, protected by a north pier and revetment 2,226 feet long and a south pier and revetment 1,847 feet long. Periodical dredging is necessary to secure the projected depth of 16 feet. The maximum draft which on June 30, 1908, could be carried over the shoalest point in the improved channel was 15 feet.

Dredging operations for the temporary restoration of the channel depths were prosecuted August 21 to September 13 and November 21 to December 12, 1907, and April 17 to May 1, 1908, and removed 66,354 cubic yards.

The funds on hand will barely be sufficient to cover the cost of another short period of dredging by the United States dredge, consequently the $5,000 asked for is intended to cover two years' dredging operations.

Soundings made May 23–25, 1908, showed a condition of channel as follows: Outside 15.8 to 16 feet and 15 feet between the piers.

The commercial importance of this harbor is not great. The important harbor of Ludington is only 12 miles north of Pentwater.

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1884, page 1980.

The improvement is reported to have materially reduced freight rates by water and secured corresponding reductions in railroad rates.

Entrances and clearances.

WHITE LAKE HARBOR.

Calendar year.	Number.	Tonnage.
1906	78	87,388
1907	191	136,866

Total freight carried, calendar year—
1906 ..... tons .. 400
1907 ..... do 4,130

PENTWATER HARBOR.

Calendar year.	Number.	Tonnage.
1906	2,264	385,396
1907	2,959	529,355

Total freight carried, calendar year—
1906 ..... tons .. 13,413
1907 ..... do 2,532

WHITE LAKE HARBOR.

July 1, 1907, balance unexpended	$14,386.15
June 30, 1908, amount expended during fiscal year for maintenance of improvement	6,817.14
July 1, 1908, balance unexpended	7,569.01
July 1, 1908, outstanding liabilities	497.00
July 1, 1908, balance available	7,072.01
Amount (estimated) required for completion of existing project	21,720.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

PENTWATER HARBOR.

July 1, 1907, balance unexpended	$11,355.96
June 30, 1908, amount expended during fiscal year for maintenance of improvement	8,000.65
July 1, 1908, balance unexpended	3,355.31
Amount (estimated) required for completion of existing project	26,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

[a] See consolidated money statement on page 704.

CONSOLIDATED.

July 1, 1907, balance unexpended	$25,742.11
June 30, 1908, amount expended during fiscal year for maintenance of improvement	14,817.79
July 1, 1908, balance unexpended	10,924.32
July 1, 1908, outstanding liabilities	497.00
July 1, 1908, balance available	10,427.32
Amount (estimated) required for completion of existing project	48,120.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	151,000.00

(See Appendix N N 8.)

9. Ludington Harbor, Michigan.—This harbor is the outlet of Pere Marquette River, which expands into Pere Marquette Lake before emptying into Lake Michigan. In 1867, before improvement was begun by the United States, the outlet from Pere Marquette Lake to Lake Michigan had a length of 830 feet, protected by diverging slab piers. The entering depth was 7 to 8 feet.

The former project was adopted in 1867 and modified in 1885, 1889, 1890, and 1899. In its final form, as adopted by the river and harbor act of March 3, 1899, it provided for a through channel 183 to 285 feet wide and 18 feet deep, protected by the requisite piers and revetments. Estimated amount required to complete revised project was $210,000. It can not be said that the modifications of the original project materially changed it in any regard. The development of the harbor has been progressive, the changes in the original project affecting only the length of the piers and their direction and the depth between them. It may therefore be said that the estimated cost of completion of that project is really the sum of the above amount and that previously expended, or $591,055.91 in all.

To June 30, 1908, the sum of $621,702.85 was expended upon the original project and its subsequent modifications. Of the above, $492,442.73 was expended for construction and $129,260.12 for maintenance. As a result of the above expenditure there now exists a reasonably reliable 18-foot channel, protected by piers and revetments. Annual dredging is necessary, however, to maintain a channel of 18 feet in depth and of sufficient width.

The U. S. dredge *Gillespie* operated at this harbor November 5–20, 1907, and restored the channel so as to afford 22 feet depth outside and 20 feet depth between the piers.

Soundings made May 20–21, 1908, showed that there is still an available depth of 21.8 feet outside and 20 feet between the piers.

In addition to the above dredging operations, a contract for minor repairs to the north pier, involving an expenditure of $496.64, was made and will soon be completed. Bids for delivery of stone filling at portions of the piers, involving an expenditure of $900, were opened June 29, 1908.

The act of March 2, 1907, changed the project by appropriating $100,000 for the construction of an exterior stilling basin in accordance with report printed in House Document No. 62, Fifty-ninth Congress, first session, and authorizing further expenditure, under continuing contract, of $739,087, of which $719,087 is yet to be appropriated, for completing the project.

A contract has been made for the construction of 3,600 feet of the two breakwater arms; work was commenced early in May, 1908, and is in progress.

It is estimated that $200,000 might advantageously be expended on the breakwater construction in one year under the above contract, and that $3,000 for dredging, $2,000 for repairs, and $3,000 for contingencies should also be provided.

To June 30, 1908, the sum of $1,026.51 was expended on new project.

This harbor is one terminus of the main line of the Pere Marquette Railroad Company, which operates lines of car ferries from this point to Manitowoc, Wis., and Milwaukee, Wis. A line of passenger and package freight steamers owned by the railroad company also makes regular sailings to Milwaukee. The business done by the car-ferry lines is of enormous and constantly increasing importance in its effect upon freight rates to and from the Northwest. The volume of this business has steadily increased. It is desirable to give to the car-ferry service the same assurance of regularity of schedule as exists in the case of the ordinary railroad lines. At present difficulty is usually experienced in the fall and winter months, due to the narrowing of the channel by a shoal from the north. The car ferries are large and unwieldy and require ample sea room. A narrow channel is therefore impracticable, and to insure safety and regularity to the service dredging should be done as late in the fall as is possible with the type of dredge available. With the United States seagoing hydraulic dredge available, there will be practically no time when dredging can not be done.

It is expected to apply the funds on hand, and those to be appropriated, to continuing improvement, maintenance, and contingencies.

Definite information as to the effect of the improvement on freight rates could not be ascertained.

Entrances and clearances.

Calendar year.	Number.	Tonnage.
1906	3,123	4,424,161
1907	3,261	4,545,732

Total freight carried, calendar year—

1906 ..... tons 1,497,424
1907 ..... do 1,570,720

July 1, 1907, balance unexpended		$145,407.23
Amount appropriated by sundry civil act approved May 27, 1908		20,000.00
		165,407.23
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$866.94	
For maintenance of improvement	2,808.62	
		3,675.56
July 1, 1908, balance unexpended		161,731.67
July 1, 1908, outstanding liabilities		233.00
July 1, 1908, balance available		161,498.67
July 1, 1908, amount covered by uncompleted contracts		142,496.64
Amount (estimated) required for completion of existing project		719,087.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908:		
For works of improvement	$200,000.00	
For maintenance of improvement	8,000.00	
		208,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix N N 9.)

10. Manistee Harbor, Michigan.—In 1866, previous to the beginning of work by the United States, the entrance to this harbor was improved by slab piers, 100 to 150 feet apart, built by local enterprise, a navigable depth of 7 to 8 feet being thereby maintained.

The project adopted in 1867 and amended in 1871, 1873, 1875, 1884, 1890, and 1892, provides for a channel of navigable width with a depth of 15 feet, extending from Lake Michigan to Manistee Lake, protected by piers and revetments at the entrance. The various modifications of the original project merely extended its limits, changed the proposed length of the piers, and the proposed depth from 12 to 15 feet. Operations have been progressive, and no work under any of the projects not essential to the project in its final form has been done.

To June 30, 1908, there had been expended $442,475.60, of which $329,996.18 was for construction and $112,479.42 for maintenance.

As a result of the above total expenditure to June 30, 1908, there had been built 2,906 linear feet of north and 1,450 linear feet of south pier and revetment, the width between the piers varying between 150 feet inside and 190 feet at the outer end of the south pier, which is 250 feet shorter than the north pier. The piers and revetments are in fair condition, but the portion of the north revetment occupied by the Manistee and Northeastern Railroad Company, referred to in the Annual Report of the Chief of Engineers for 1899, page 2940, still remains without repairs, and a portion of the south pier 155 feet in length is some twenty-five years old and requires renewal above water.

The act approved March 2, 1907, changed the project by providing for improvement in accordance with report submitted in House Document No. 511, Fifty-ninth Congress, first session, which contemplates securing a uniform depth of 18 feet, by dredging to a depth of 20 feet, pier extension, revetment, and protection works, at an estimated cost of $147,488, provided satisfactory pledge is given that certain private and municipal work will be completed within a reasonable time, that land for the improvement will be donated,

and that the United States shall be protected from claims for damages which may result from the work.

Until the conditions precedent to the enlargement of the project as above have been met, it is proposed to apply the available balance ($24,509.27) and such funds as may be appropriated and needed in maintenance, i. e., in dredging two years at an estimated cost of $5,000 per year and in repairs to the piers at an estimated cost of $17,000. The extension of the south pier 100 feet in completion of the project, at an estimated cost of $12,000, and one year's dredging operations should be provided for this harbor irrespective of action being taken locally that would allow work to be done on the enlarged project.

The through channel has at various times been dredged so as to afford the projected depth of 15 feet. This channel, however, requires periodical dredging. The maximum draft which on June 30, 1908, could be carried through the improved channel was 16 feet. Soundings made April 24–30, 1908, showed a mid-channel depth of 16 feet.

Two of the three bridges that span the channel between Manistee Lake and Lake Michigan, i. e., the channel of Manistee Harbor, have draws that are too narrow for the U. S. dredge *General Gillespie* to pass through them with safety, and as the channel inside the bend near the life-saving station is too narrow for the dredge to turn around, operations by the Government dredge have necessarily been confined to the portion of the channel outside the bend and to the outer bar.

Dredging under contract in the inner reaches was carried on August 5 to September 6, 1907, and June 22–30, 1908, and 32,520 cubic yards was removed.

Reference to reports on preliminary examination and survey, ordered by the river and harbor act approved March 3, 1905, will be found on page 644 of the report for 1906.

The commerce tributary to this harbor is derived principally from the salt and lumber industries. The harbor is also a regular port of call for one line of steamers plying from Chicago to points upon the east shore of Lake Michigan, and a single steamer makes stated trips from Manistee to Milwaukee. There are three railroads running into Manistee, being the Pere Marquette, the Manistee and Grand Rapids, and the Manistee and Northeastern.

The last published map of this locality is found in House Document No. 511, Fifty-ninth Congress, first session.

Definite information as to the effect of the project on freight rates could not be ascertained.

Entrances and clearances.

Calendar year.	Number.	Tonnage.
1906	2,152	967,758
1907	2,472	1,048,398

Total freight carried, calendar year—

1906	tons	443,931
1907	do	356,864

July 1, 1907, balance unexpended	$36,692.62
June 30, 1908, amount expended during fiscal year for maintenance of improvement	7,143.35
July 1, 1908, balance unexpended	29,549.27
July 1, 1908, outstanding liabilities	40.00
July 1, 1908, balance available	29,509.27
July 1, 1908, amount covered by uncompleted contracts	5,000.00
Amount (estimated) required for completion of existing project	122,488.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	17,000.00

(See Appendix N N 10.)

11. Harbor of refuge at Portage Lake, Manistee County, Mich.—In 1879, when work was begun by the United States, there was a channel 4 feet deep and 130 feet wide between slab piers built by local enterprise.

The approved project, adopted in 1879 and amended in 1881 and 1890, contemplates the construction of a harbor of refuge, with an entrance from Lake Michigan 356 feet wide and 18 feet deep, protected by piers and revetments. Estimated cost, revised in 1897 and 1899, was $344,300.

The modifications of the original project have in no way changed its scope, so that essentially the project is to-day as when originally adopted. All expenditures made up to the present time have contributed to the completion of the project in its present form.

To June 30, 1908, there had been expended the sum of $376,491.78, of which $254,129.21 was for construction and $122,362.57 for maintenance. The approved project is now completed only as far as pier construction is concerned.

The harbor structures are in good condition. The north pier, comprising 114 feet of pile work in wing at inner end, 1,235 feet of pile work along channel, and 851 feet of cribwork, has a total length of 2,200 feet and projects 1,210 feet beyond the shore line. The south pier, comprising 1,399 feet of pile work, including 17 feet of wing at east end, and 901 feet of cribwork, has a total length of 2,300 feet and projects 1,210 feet beyond the shore line.

The United States dredge operated at this harbor October 14 to November 4, 1907, and removed 38,377 cubic yards.

As shown by soundings made May 4–8, the maximum draft that could be carried from Lake Michigan to Portage Lake, on June 30, 1908, was 17 feet.

It is estimated that there are 100,000 cubic yards that should be removed from between the piers to reduce the high banks, and that $15,000 would be required to complete this work, it having been found impossible to remove all the material by use of the United States dredge, and $3,000 should be provided for maintenance.

There is little local commerce. The harbor of refuge serves to permit vessels engaged in the general lake commerce, if necessary, to approach more closely the east shore of Lake Michigan, which in this vicinity has hitherto been destitute of harbors readily available in foul weather.

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1884, page 1974.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Total freight carried.
			Tons.
1907	360	109,080	3,793

July 1, 1907, balance unexpended	$12,928.29
June 30, 1908, amount expended during fiscal year for maintenance of improvement	9,920.07
July 1, 1908, balance unexpended	3,008.22
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	18,000.00

(See Appendix N N 11.)

12. Arcadia Harbor, Michigan.—The act of March 3, 1905, appropriated $6,000 for the improvement of this harbor in accordance with report submitted in House Document No. 194, Fifty-eighth Congress, second session.

While a plan was submitted for rebuilding the piers at a cost of $90,390, and annual maintenance and dredging at a cost of $5,200, the plan that was recommended and approved was for maintenance of the present channel by dredging only, at a cost of $3,000 annually for a period of five years, at the end of which time, if a growth of the commerce is manifested such as to warrant larger expenditures, the plan for radical improvement by reconstruction of the piers could be undertaken. At the time of the survey, September, 1902, the depth was some 12 feet, in a narrow and rather difficult channel, and this depth would be considerably reduced during the usual lowering of the lake surface in the months of October and April, so that only 10 feet could be safely counted on as the navigable depth. The piers terminate at the 10-foot contour.

To June 30, 1908, there had been expended $11,538.48 for dredging.

Dredging operations under contract were commenced July 17 and completed August 3, and resulted in restoring a channel 12 feet deep and 60 feet wide from the inner lake to Lake Michigan. The dredged material measured 18,353 cubic yards.

The channel was surveyed May 9–11, 1908, and the available depth between the piers was found to be 7.5 feet.

Dredging operations were again carried on May 22 to June 18, 1908, under contract and 14,150 cubic yards removed, restoring a channel 50 feet wide and 12 feet deep.

What is stated in reporting on White Lake and Pentwater harbors in report for 1906 relative to cost of dredging by contract and by the U. S. dredge *General Gillespie* applies to this harbor, too; consequently, should the plan submitted in House Document No. 194,

Fifty-eighth Congress, second session, be fully adopted, it would be in the interests of economy to provide a 16-foot projected depth. Dredging is the principal cost for maintenance at the harbors on the east shore of Lake Michigan, and a reduction of 67 per cent in this cost is well worth considering, even though an enlarged first cost for original construction might thereby be entailed. With the prevailing draft of freight boats, it may be said in general that the time is probably past when a projected depth of 12 feet, in aid of commerce at any of the harbors, is longer adequate.

The number of tons of various articles shipped and received and the entrances and clearances of vessels from 1894 to 1901, inclusive, are shown on page 576 in Report of Chief of Engineers for 1905.

The money to be appropriated will be applied to dredging. Under the existing project $3,000 is still to be provided.

Definite information as to the effect of the project on freight rates could not be ascertained.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Total freight carried.
			Tons.
1906	945	80,278	2,014
1907	1,484	109,792	70,556

July 1, 1907, balance unexpended	$7,254.52
June 30, 1908, amount expended during fiscal year for maintenance of improvement	6,793.00
July 1, 1908, balance unexpended	461.52
July 1, 1908, outstanding liabilities	77.00
July 1, 1908, balance available	384.52
July 1, 1908, amount covered by uncompleted contracts	290.07
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	3,000.00

(See Appendix N N 12.)

13. Frankfort Harbor, Michigan.—In 1867, when the United States began work of improvement at this harbor, which is the outlet to Lake Aux Becs Scies, there existed an outlet about 750 feet north of the present channel, affording a depth of 3 to 4 feet and width of 70 to 80 feet between slab piers, built by local enterprise.

The project, adopted in 1866 and amended in 1868, 1879, and 1892, provided for a new outlet, with channel 12 feet deep and 200 feet wide, protected by piers and revetments. The estimated cost, revised in 1897 in compliance with the river and harbor act of June 3, 1896, to cover the cost of securing a channel 18 feet deep, was $413,659.85; further revised in 1899 to $421,938.35. The changes in the original project have been in effect merely extensions, so that the existing

project does not differ in kind from the original one. All expenditures may therefore justly be regarded as pertaining to the present project.

To June 30, 1908, there had been expended the sum of $436,741.81, of which $321,508.20 was for construction and $115,233.61 for maintenance. The total expenditure above mentioned has resulted in the creation and maintenance of a channel 18 feet deep, whose natural depth, or depth to which the channel would probably shoal in a few years without dredging, is 12 feet, the width being 200 feet. It is protected by a north pier and revetment 1,900 feet long and a south pier and revetment 1,938 feet long, of which the outer 400 feet was built by the Toledo and Ann Arbor Railroad Company. Dredging from time to time will be required to maintain the depths needed for navigation.

Operations were carried on by the U. S. dredge *Gillespie*, April 10–16, 1908, 9,556 cubic yards having been removed and the outer bar deepened from 16 to 21 feet.

Soundings made May 13–14, 1908, showed a depth of 18 to 20 feet over the outer bar and 18.2 feet between the piers.

Minor repairs were made to the piers where injured by colliding vessels during the year. The funds on hand are expected to be applied to dredging operations and to repairs, and incidentally to extend the south pier 100 feet while making repairs to that pier.

A contract has been made for 60 feet extension to the south pier and 40 feet repairs to the outer end of this pier. Operations, commenced June 25, 1908, are in progress and are to be completed November 1, 1908.

The available balance at this harbor, $19,866.28, will be sufficient to make required repairs estimated at $5,000, and to provide for two years dredging operations estimated at $5,000; consequently $13,200 is asked for to extend the north pier 100 feet in completion of project.

Practically the entire commerce of this harbor is transacted by the car-ferry lines of the Ann Arbor Railroad, which has its northern terminus at this harbor. These car ferries run to Kewaunee and Marinette, Wis., upon the west shore of Lake Michigan, and form a highly important link in the through commerce between the Northwest and the Atlantic seaboard. The importance of maintaining adequate facilities at Frankfort Harbor is manifest. This can be done with certainty only by repeated radical dredging. Pier extension unaccompanied by thorough dredging will not serve.

The last published map of this harbor is found in the Annual Report of the Chief of Engineers for 1884, page 1973.

Definite information as to the effect of the project on freight rates could not be ascertained.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Total freight carried.
			Tons.
1906	1,633	1,493,089	719,259
1907	1,780	1,963,564	630,182

July 1, 1907, balance unexpended		$40,764.83
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$49.18	
For maintenance of improvement	5,019.11	
		5,068.29
July 1, 1908, balance unexpended		35,696.54
July 1, 1908, outstanding liabilities		117.00
July 1, 1908, balance available		35,579.54
July 1, 1908, amount covered by uncompleted contracts		15,713.26
Amount (estimated) required for completion of existing project		13,200.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		13,200.00

(See Appendix N N 13.)

14. Charlevoix Harbor and entrance to Pine Lake, Michigan.—In 1868, when the first estimate for improvement was made, the available channel in Pine River between Lake Michigan and Round Lake was 75 feet wide and 2 to 6 feet deep. Up to 1873 the local authorities, with some assistance from the State, had constructed 468 feet of cribwork in the north pier and 80 feet of cribwork in the south pier, and the available depth was 6 feet. The first appropriation by the United States was made in 1876, and actual operations were begun in fiscal year 1878 upon the lower channel; the first appropriation for the upper channel was made in 1882, and actual work begun in 1885. Total estimated cost was $186,000.

The original project was proposed in 1868, and as amended in 1876 and 1882 provided for a 12-foot channel from Lake Michigan to Round Lake (lower channel), between piers and revetments, 100 to 150 feet apart, and from Round Lake to Pine Lake (upper channel), between revetments, 83 feet apart. The following provision of the river and harbor act of June 13, 1902, may be said to have extended the scope of the original project: "Improving harbor at Charlevoix and entrance to Pine Lake, Michigan: Continuing improvement, twenty thousand dollars, to be first expended in obtaining a uniform depth of channel from Lake Michigan to Pine Lake." The controlling depth of the lower channel in June, 1902, was 16.3 feet.

The project for this harbor contemplates 200 feet extension of the piers, additional repairs of the piers and revetments, and dredging from time to time, as required.

The contract for repairs to north pier, lower channel, and south pier, upper channel, was completed November 30, 1907.

A contract has been made for repairs to the inner end of south pier, lower channel; work commenced March 28, 1908, and was completed June 22, 1908.

The available balance, $15,143.41, is expected to be expended in further repairs to the piers, in dredging operations, and contingencies.

The completion of the project contemplates 200 feet extension to the south pier, estimated at $23,750, and $6,000 might well be provided for incidental repairs, dredging, etc., making $29,750 that is asked for.

Up to June 30, 1908, the sum of $201,629.53 had been expended upon the existing project and its various modifications. The result

was a channel 17 feet deep, whose natural depth is 10 feet, protected in its two divisions by a north pier and revetment 2,064 feet long and a south pier and revetment 2,396 feet long. Of the above total expenditure, $80,205.04 was for construction and $121,424.49 for maintenance.

Soundings made May 15–18, 1908, showed a depth of 19 feet on the outer bar, 16.6 feet in the lower channel, and 15.9 feet in the upper channel; it is expected that the U. S. dredge *Gillespie* will be operating at this harbor during the season of 1908.

The principal traffic tributary to this harbor is furnished by the lumber industry, which has recently been growing greatly in importance. The principal sawmills are situated at Boyne and East Jordan, both at the upper end of Pine Lake, the outlet for which is through both channels. Due to the fact that many of the lumber-carrying vessels do not clear at Charlevoix, the commercial statistics fail to disclose the full traffic, which is, however, known to be considerably over 1,000,000 tons. Charlevoix is also a much-frequented summer resort, and during the summer season two steamboat lines make regular and frequent calls at this harbor. There is in addition a small amount of local traffic. A depth of 17 feet at zero of gauge should be maintained to enable the larger class of vessels to transact their business with economy.

The report upon a survey made with a view to obtaining a 16-foot channel is published in full in the Annual Report of the Chief of Engineers for 1897, pages 2953–2954, and is also printed with a map in House Document No. 144, Fifty-fourth Congress, second session.

Report of the examination authorized by the river and harbor act approved June 13, 1902, has been printed as House Document No. 222, Fifty-eighth Congress, second session.

Definite information as to the effect of the improvement on freight rates could not be ascertained.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Total freight carried.
			Tons.
1906	250	144,619	36,413
1907	314	179,055	58,984

July 1, 1907, balance unexpended	$26,448.79
June 30, 1908, amount expended during fiscal year for maintenance of improvement	7,458.67
July 1, 1908, balance unexpended	18,990.12
July 1, 1908, outstanding liabilities	104.00
July 1, 1908, balance available	18,886.12
July 1, 1908, amount covered by uncompleted contracts	3,742.71
Amount (estimated) required for completion of existing project	23,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	29,750.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix N N 14.)

15. Petoskey Harbor, Michigan.—Before work at this harbor was begun by the United States its landing pier was exposed to winds coming from between west and northwest, and in high gales it was dangerous to attempt a landing.

A project was adopted in the river and harbor act of August 18, 1894, which provided for constructing a breakwater 600 feet long about 600 feet west of the outer end of the landing pier and another north of it 500 feet long, or as much longer as might be found necessary to cover the landing from all dangerous seas. Work was begun in 1896. Estimated cost was $170,000.

To June 30, 1908, there had been expended upon this work $125,491.66, of which $118,239.40 was for construction and $7,252.26 for maintenance. Four hundred feet of the west breakwater and 200 feet of the north breakwater were built of timber cribs resting upon a stone foundation in deep water and upon natural bottom in shallow water. The remaining 200 feet of the west breakwater has been constructed of riprap stone and bowlders of suitable size. The river and harbor act of June 13, 1902, provided as follows: "Improving harbor at Petoskey, Michigan: Continuing improvement and for maintenance, fifteen thousand dollars, and the Secretary of War is hereby authorized to change or modify existing plans: *Provided*, That the total of expenditure shall not exceed the amount estimated to complete under the existing project." Investigation showed that the north breakwater was too near the wharf and that the entrance was too narrow. A contract was therefore authorized, after due advertisement, for the removal of the north breakwater and for the extension of the west breakwater, under which operations were completed September 29, 1906.

In 1907 a contract was made for the further extension of the breakwater 100 feet. Operations commenced under this contract July 10, 1907, and were completed May 25, 1908. This contract also included repairs to the stone breakwater.

It is recommended that at least 100 feet more be added to the breakwater, estimated to cost $15,000, and that $3,000 be provided for incidentals.

Definite information as to the effect of the project on freight rates could not be ascertained.

Statement of entrances and clearances could not be obtained.

July 1, 1907, balance unexpended		$22,010.18
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$17,128.26	
For maintenance of improvement	4,873.58	
		22,001.84
July 1, 1908, balance unexpended		8.34
Amount (estimated) required for completion of existing project		56,900.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		18,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix N N 15.)

EXAMINATION MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF MARCH 2, 1907.

Report dated May 29, 1907, by a Board of Engineers on examination of *Grand River, Michigan*, with a view to the regulation of the floods in the interest of navigation, was duly submitted and reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law. The report was transmitted to Congress and printed in House Document No. 72, Sixtieth Congress, first session.

IMPROVEMENT OF RIVERS AND HARBORS IN THE DETROIT, MICHIGAN, DISTRICT.

This district was in the charge of Col. Chas. E. L. B. Davis, Corps of Engineers, to February 15, 1908, having under his immediate orders Capt. George R. Spalding, since January 10, 1908, in the temporary charge of Captain Spalding from February 15 to March 2, 1908, and in the charge of Lieut. Col. C. McD. Townsend, Corps of Engineers, since March 2, 1908, with Captain Spalding under his immediate orders. Division engineer, Col. G. J. Lydecker, Corps of Engineers, to November 15, 1907, Colonel Davis, from November 15, 1907, to February 15, 1908, and Lieut. Col. W. L. Fisk, Corps of Engineers, since February 15, 1908.

1. Ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo.—In its natural state the channel connecting Lake Superior and Lake Huron was obstructed by the rapids of the St. Marys River, and navigation through other connecting channels was difficult and dangerous for boats drawing 8 feet. In 1855 the State of Michigan completed a canal at Sault Ste. Marie, with locks which were 350 feet long, 70 feet in width, and about 12 feet in depth on the miter sills. Prior to the civil war the channels through Lake George on the St. Marys River and through the St. Clair Flats at the outlet of St. Clair River were deepened to 12 feet by the General Government.

When the construction of the Weitzel lock was undertaken, providing for a navigable depth of 16 feet, it became necessary to increase channel depths not only at the localities above mentioned, but also at other localities on the St. Marys River and Detroit River. These improvements were made under specific appropriations for the localities where the work was required, as explained elsewhere in this report under the heads of St. Marys River, Hay Lake, St. Clair Flats, and Detroit River improvements.

When in 1890 the construction of the Poe lock was undertaken, providing for a depth over the miter sill of 21 feet at mean lake levels, a deepening of the channel at other localities became necessary, and the river and harbor act of July 13, 1892, authorized an expenditure of $3,340,000 for a ship channel "twenty and twenty-one feet deep, and a minimum width of 300 feet in the shallows of the connecting waters of the Great Lakes," at localities not especially provided for by the then existing appropriations.

This project originally provided for improvements at eight localities, i. e., 1, at Round Island shoals in the upper St. Marys River; 2, in Little Mud Lake, St. Marys River; 3, at Sailors Encampment, St. Marys River; 4, in Mud Lake, St. Marys River; 5, at the foot of Lake Huron; 6, at the mouth of the St. Clair River; 7, at entrance

to the Detroit River in Lake St. Clair, and 8, at the mouth of the Detroit River. By 1897 channels 300 feet wide and 20 feet deep at mean lake level, as determined by gauge readings up to the time of the adoption of the project, had been secured at a cost of $2,212,000.

The sundry civil act of June 4, 1897, authorized the expenditure of the balance of the appropriation for the maintenance of the project and its further extension to localities where recent surveys had shown that greater depths were necessary. Since 1898, therefore, the expenditures from the available balance of the appropriation have been for widening and deepening the channels of the original project and for the removal of isolated shoals, usually of small area, which have been found to interfere with the safe navigation of the channel by the larger and deeper draft vessels now in commission. The principal additional works thus accomplished have been the removal of the Vidal shoals in the upper St. Mary's River, Squaw Island and Sweet Point shoals at the mouth of the St. Marys River, Crab Island shoal in Detour Passage, the shoal in the St. Clair River at the mouth of the Black, the St. Clair Middle Ground shoal in the St. Clair River opposite the city of St. Clair, and Squirrel Island shoal in the same river. In addition a new channel west of Stag Island, St. Clair River, has been opened by the removal of several shoals interfering with deep-draft navigation, and considerable work in the Detroit River has been done that was not contemplated in the original project.

Since 1892 the levels of Lakes Huron, St. Clair, and Erie have been almost continuously below the plane adopted as mean lake level at the time of the authorization of the original project and, as a consequence, the actual draft available throughout the improved channels has varied from 17 to 19 feet. The slopes of the St. Marys River have also been affected by the dredging of channels through it. On account of these facts a new datum for the various improvements was adopted in 1902. This new datum plane is that of the low water of 1895, which varies, as explained in the Annual Report of the Chief of Engineers for 1904, page 552, from 2 to 3 feet below the mean lake levels. In addition to the annual variations in levels the mean monthly levels may vary from 4 inches to 2 feet in a single year, and daily variations in the water surface may amount to 2 feet in variable weather, or even to 6 and 8 feet in severe storms, on Lakes Superior and Erie.

The total expenditure on the improvements to June 30, 1908, was $3,338,469.55. With this expenditure and specific appropriations for special localities, channels not less than 300 feet in width, with depths varying from 20 to 23 feet below mean lake levels, have been constructed, connecting the waters of the Great Lakes between Chicago, Duluth, and Buffalo, as called for by the project.

The only work done during the fiscal year ending June 30, 1908, has been the widening of the channel at Round Island shoals and at Vidal shoals, and at the close of the fiscal year this work is practically completed, except for some cleaning up after the dredges for which the available balance is sufficient.

Regulations governing the use of the channels at Stag Island were promulgated by the Secretary of War under date of January 8, 1907, and concurred in by the Canadian government, and a watchman has been stationed at this point to report violations of these rules.

With the practical exhaustion of this appropriation, there will be no funds in hand which will be available for channel examinations or maintenance. From past experience it is believed that a limited amount of money should be available for such examinations, and for the removal of shoals disclosed by them, and it is believed that an annual appropriation of $25,000 should be made available for this purpose, with the expectation that should an extension of present projects be later found necessary, specific appropriations therefor will be made available.

The amount of freight carried through the St. Marys River section of the channel during the navigation season of 1907 was 58,217,214 freight tons, valued at $569,830,188, exclusive of local traffic amounting to about 1,500,000 tons. Statistics of traffic through the St. Clair Flats Canal indicate that 66,271,962 tons of freight passed through this section, while that passing Detroit River amounted to 71,226,895 tons, valued at $697,311,302.

It is believed that to attribute to the improvement in channels the difference in freight rates of 1900 (1.18 mills per mile-ton) and 1907 (0.80 mills per mile-ton) would not exaggerate the effect of the improvement, especially in view of the fact that the greater permissible draft has produced vessels of greater tonnage, the carrying capacity of freight steamers having increased from 8,000 tons in 1900 to 13,000 tons in 1907.

July 1, 1907, balance unexpended	$11,397.20
June 30, 1908, amount expended during fiscal year for works of improvement	9,866.75
July 1, 1908, balance unexpended	1,530.45

(See Appendix O O 1.)

2. St. Marys River at the falls, Michigan.—The St. Marys rapids are about one-half mile wide and three-fourths of a mile long. The fall ranges from 16½ feet to 20¼ feet with varying stages of water. The water surface, usually changing slowly, may have an extreme range of 6 feet in a few hours, and the monthly mean elevation of the surface may change as much as 2 feet in one year, or 4 feet during forty years.

Commercial navigation of the falls, or rapids, of this river at Sault Ste. Marie was impracticable until 1855, when the State of Michigan constructed a canal which provided a navigable channel for vessels whose draft was 11.5 feet at mean stage of water, at a cost of about $1,000,000, the proceeds of 750,000 acres of land granted by the United States Congress. This improvement was completed in 1855, the double-lift lock having tandem chambers 350 feet long and 70 feet wide, with gate openings of 70 feet arranged for 9 feet average lift at each lock, and the canal being about 5,700 feet long, with an available width of 64 feet and a top width of 100 feet. The commerce in 1870 was about 540,000 tons per year.

In 1870 the United States entered upon a project for increasing the canal to at least 100 feet width, replacing the stone slope walls with timber revetment piers, building a new lock, and providing for 16 feet draft. This lock (now known as the Weitzel lock) was opened to traffic in 1881, its single chamber being 515 feet long and 80 feet wide, narrowed at gate openings to 60 feet and arranged for

18 feet average lift. The cost of the work from 1856 to 1885, inclusive, was $2,875,692, including $10,000 diverted from the 1864 Great Lakes appropriation. A rapidly increasing commerce developed as a result of these improvements.

The project presented in reports dated October 18 and December 22, 1886, provided for building, on the site of the old State locks, a new lock with a single lift of 16 to 21 feet, the chamber being 800 feet long by 100 feet wide, with 21 feet of water at mean stage on the miter sills; also for deepening the canal and its approaches, all at an estimated cost of $4,738,865. By authority of river and harbor act of August 5, 1886, work under this project was begun, and the essential features of the project were so far completed in 1896 as to permit the new lock to be opened to navigation August 3 of that year. This lock has since been known as the Poe lock. Later work has consisted in completing the deepening of the canal and its approaches, rebuilding and extending canal piers, grading and improving canal grounds, etc.

The river and harbor act of June 13, 1902, authorized the following diversions from existing funds, namely, $20,000 for special improvement at Sailors Encampment, $20,000 for salaries and expenses of the International Waterways Commission, and $85,000 estimated as the amount required to complete certain improvements at St. Clair Flats Canal, for which existing funds pertaining to the latter work were insufficient. The act also provided for extending the work at the falls so as to include widening and further improvement of the canal above the locks, in accordance with the project submitted in House Document No. 128, Fifty-sixth Congress, second session, but made no additional appropriation therefor.

The river and harbor act of March 3, 1905, authorized the expenditure under continuing contract of $1,020,000 for widening canal as proposed in project submitted in House Document No. 215, Fifty-eighth Congress, third session. Of this $1,020,000 there remains to be appropriated $250,000, and this amount can be profitably expended during the fiscal year ending June 30, 1910, to be applied to rock and earth excavation, concrete revetment walls, timber piers, filling, movable dams, including head gates, and to superintendence and contingencies, all in accordance with project above mentioned.

The river and harbor act of March 2, 1907, adopted a project for the construction of a new lock, with a separate canal, in accordance with "plan 3," set forth in House Document No. 333, Fifty-ninth Congress, second session, at an estimated cost of $6,200,000, of which $1,200,000 has been appropriated and the balance authorized to be expended under continuing contract, but not yet appropriated.

During the fiscal year the titles to the land required for widening the existing canal have been acquired. A contract for the work was awarded the Great Lakes Dredge and Dock Company, which commenced operations May 6, 1908, and have excavated 39,401 cubic yards of material. The construction of the center pier and abutments for the emergency dam was completed by the United States, as far as this is practicable at present, and the sill for the dam across the present channel is finished. Plans for the superstructure, including machinery, details, and specifications, have been prepared.

Work on the new lock and canal has consisted in the construction of about 1,600 feet of the cofferdam surrounding the lock pit and work on the completion of the dam is being pressed. Some 20,000 cubic yards of material has been excavated from the lock pit for use in the cofferdam, a small amount of this material having been removed from island No. 5 by hired labor.

Borings have been made to determine the character of the rock strata for the purpose of preparing specifications for excavation and plans for the lock walls.

The necessary surveys and estimates have been made for the work, and the plans for the walls, machinery, and culverts are under study.

The total expenditures to June 30, 1908, under present project for general improvement are $4,652,077.73, of which amount $20,000 was applied to Sailors Encampment, $1,704.22 to expenses of International Waterways Commission, and $86,491.28 to the St. Clair Flats Canal, leaving an unexpended balance of $863,491.49. The balance of the $20,000 diversion ($18,295.78 not included in total expenditures) for International Waterways Commission was transferred to the Commission.

Expenditures to June 30, 1908, for new lock and canal were $54,287.80, leaving an unexpended balance of $1,145,712.20.

The commerce passing the falls during the navigation season of 1907, a period of seven months and twenty-three days, amounted to 58,217,214 tons of freight, valued at $569,830,188. The number of passengers reported during the same period was 62,758.

More detailed information may be found in Annual Report of the Chief of Engineers for 1886, pages 1792 to 1808, and for 1907, page 2034 (historical notes).

CANAL WIDENING, ETC.

July 1, 1907, balance unexpended	$917,926.79
June 30, 1908, amount expended during fiscal year for works of improvement	[a] 54,435.30
July 1, 1908, balance unexpended	863,491.49
July 1, 1908, outstanding liabilities	17,356.82
July 1, 1908, balance available	846,134.67
July 1, 1908, amount covered by uncompleted contracts	660,000.00
Amount (estimated) required for completion of existing project	250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[b] 250,000.00

[a] Actual expenditures during the fiscal year were $55,730.87, in addition to $5.77 and $5.51 paid by Treasury Department, account of Duluth, South Shore and Atlantic Railway Company and Michigan Central Railroad Company, respectively, making the total expenditure $55,742.15; from this amount $1,306.85 (receipts from sale of condemned Government property) has been deducted, leaving the net expenditure $54,435.30.

[b] Balance of contract authorization of 1905.

NEW LOCK AND CANAL.

July 1, 1907, balance unexpended	$1,200,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	[a] 54,287.80
July 1, 1908, balance unexpended	1,145,712.20
July 1, 1908, outstanding liabilities	9,309.22
July 1, 1908, balance available	1,136,402.98
July 1, 1908, amount covered by uncompleted contracts	20,000.00
Amount (estimated) required for completion of existing project	5,000,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[b] 500,000.00

CONSOLIDATED.

July 1, 1907, balance unexpended	$2,117,926.79
June 30, 1908, amount expended during fiscal year, for works of improvement	108,723.10
July 1, 1908, balance unexpended	2,009,203.69
July 1, 1908, outstanding liabilities	26,666.04
July 1, 1908, balance available	1,982,537.65
July 1, 1908, amount covered by uncompleted contracts	680,000.00
Amount (estimated) required for completion of existing projects	5,250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[c] 750,000.00

(See Appendix O O 2.)

3. Operating and care of St. Marys Falls Canal, Michigan.—The former conditions and the results of the improvement are the same as above stated for St. Marys River at the falls.

The service of operating and care is provided for by the permanent indefinite appropriation for operating and care of canals and other works of navigation under the provisions of section 4 of the river and harbor act of July 5, 1884.

The total expenditure on this account from 1881, when the Weitzel lock was first put in service, to June 30, 1908 (excluding $9,676.72 outstanding liabilities), amounted to $1,601,220.70, of which $109,918.71 related to operations for the fiscal year.

During the fiscal year ending June 30, 1908, the United States canal was open to navigation two hundred and twenty-nine days, the closed season being from December 12, 1907, to April 26, 1908, inclusive. A total of 11,715 vessels, aggregating 25,742,434 registered tons, and carrying 33,964,074 tons of freight and 33,430 passengers,

[a] Actual expenditures during the fiscal year were $54,391.38; from this amount $103.58 (payment by sureties on bond of McDonald & Fagan, contractors) have been deducted, making the net expenditure $54,287.80.

[b] Under contract authorization of 1907.

[c] Of this amount $250,000 is for work under contract authorization of 1905 and $500,000 under that of 1907.

passed through the locks in 7,937 lockages. The Canadian canal at Sault Ste. Marie, Ontario, open two hundred and thirty-nine days, made 4,183 lockages and passed 5,645 vessels, with an aggregate registered tonnage of 9,614,741, and carrying 12,467,146 tons of freight and 29,101 passengers. The combined traffic through the two canals amounted to 46,431,220 tons of freight and 62,531 passengers.

The principal items of freight during the past fiscal year through both canals were: Iron ore, 30,487,962 tons; coal, 9,420,458 tons; flour, 5,994,711 barrels; wheat, 90,561,574 bushels; other grain, 36,576,633 bushels; lumber, 539,629 M feet B. M., and general merchandise, 933,993 tons.

Other statistics in relation to this traffic and commerce for the calendar season of 1907 are summarized in the following statements:

Summary of St. Marys River commerce, via American and Canadian canals, during the calendar season of 1907, viz, from April 22 to December 15, 1907, a period of two hundred and thirty-eight days.

Total freight carried, tons	58,217,214
Total net registered tons	44,087,974
Total mile-tons	48,221,465,547
Total valuation placed on freight carried	$569,830,188
Total amount paid for freight transportation	$38,457,345
Total number of registered vessels using canals	879
Total number of passages by unregistered crafts carrying freight	346
Total valuation placed on registered vessels	$110,443,500
Total number of passengers transported	62,758
Average distance freight was carried, miles	828.3
Average cost per ton for freight transportation	$0.66
Average cost per mile per ton, mills	.80
Average value per ton of freight carried	$9.79
Time American canal was operated, days	233
Time Canadian canal was operated, days	238
Freight carried by—	
Registered vessels, tons	58,186,957
Unregistered vessels, tons	30,257
American vessels, per cent	95
Canadian vessels, per cent	5
Passengers carried by—	
American vessels, per cent	43
Canadian vessels, per cent	57
Average number of vessels passing per day—	
Through Poe lock	36
Weitzel lock	26
Canadian lock	27
Poe, Weitzel, and Canadian locks	86

Freight traffic by calendar years.

	Tons.		Tons.
1881	1,567,741	1895	15,062,580
1882	2,029,521	1896	16,239,061
1883	2,267,105	1897	18,982,755
1884	2,874,557	1898	21,234,664
1885	3,256,628	1899	25,255,810
1886	4,527,759	1900	25,643,073
1887	5,494,649	1901	28,403,065
1888	6,411,423	1902	35,961,146
1889	7,516,022	1903	34,674,437
1890	9,041,213	1904	31,546,106
1891	8,888,759	1905	44,270,680
1892	11,214,333	1906	51,751,080
1893	10,796,572	1907	58,217,214
1894	13,195,860		

For effect of channel improvement on freight rates, see remarks under this head in report of ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo (p. 717).

(See Appendix O O 3.)

4. Hay Lake and Neebish channels, St. Marys River, Michigan.—The original condition of this waterway included rapids and shoals characteristic of St. Marys River, and though passable for small craft having a draft of from 3 to 5 feet, the channel was not navigable in a commercial sense, and the route of vessels through the St. Marys River was by way of Lake George. The water surface, usually varying slowly, may have a rise or fall of 2 feet during a severe storm, and the monthly mean elevation of water surface may change as much as 2 feet in one year, or 4 feet during forty years.

The original project of 1882 contemplated the excavation of channels 17 feet deep and 300 feet wide through all obstructed portions of the Hay Lake route by way of the Middle Neebish, but this project was modified in 1886 to provide a depth of 20 feet and to widen at angles and other critical places, at a total estimated cost of $2,659,115, and the modified project was adopted by river and harbor act of August 5, 1886. The work of improvement was commenced in 1883, under War Department approval of October 27, 1882, and by 1894 work had so far progressed that the route was opened to commerce June 7 of that year, though full width and depth of channel had not been obtained, and since that time several shoals in the deep-water section of the lake have been removed and the dredged channels have been widened at critical places.

The river and harbor act of June 13, 1902, appropriated $500,000 and authorized work up to $4,000,000 more (all of which has been appropriated) for improving Middle and West Neebish channels to provide for the commencement and prosecution of the project outlined in the preliminary report of June 4, 1900 (Annual Report of the Chief of Engineers for 1901, page 3200), and the river and harbor act of March 3, 1905, appropriated $500,000 and authorized work up to $750,000 more for improving Hay Lake and Neebish channels for continuing this improvement, of which $435,000 still remains to be appropriated.

The part of the project outlined in the above-named reports relative to the river below the canal, which has been covered by these two acts, is to provide a channel 1,500 feet wide from the Sault locks to the upper entrance to Hay Lake; to widen and deepen the upper entrance channel into Hay Lake so as to give a least width of 600 feet, with clear depth of 21 feet at low water; to excavate a new channel having least width of 300 feet and low-water depth of 21 feet between Hay Lake and Mud Lake by way of the West Neebish; and to deepen the Middle Neebish channel to give depth of 21 feet at low water, leaving its width unchanged. The effect of the execution of this project will be to provide a clear navigable depth of 21 feet from St. Marys Falls Canal to Lake Huron, the least width being 300 feet where two channels are provided, one for upbound and one for downbound boats, and 600 feet at all other places.

The total amount expended to June 30, 1908, on the Hay Lake and Neebish projects combined was $7,172,409.08.

More extended information, with maps, may be found in Annual Reports of the Chief of Engineers for 1886, pages 1792–1808 (special history), and 1895, pages 2866 and 3052.

During the fiscal year the work on the lower approach to the canal was completed, and the reach from the canal to Little Rapids, a distance of 2 miles, has a least width of 1,500 feet and a depth of 21 feet below 580.4 at foot of canal and 580.2 at Little Rapids. The improvement of the channel at Sixmile Point, Hay Lake, was also completed, and the upper entrance to Hay Lake is now 600 to 1,700 feet wide, and has a least depth of 21 feet at mean low water (580.2 at Little Rapids and 579.3 at Hay Lake).

The work in the West Neebish channel has consisted in completing the channel across the flats at foot of Hay Lake. This channel is 32,300 feet long, 300 feet wide, and 21 feet deep below mean low water (579.3 feet). The channel at the rapids, which was cut through bed rock, was nearly complete at the close of the fiscal year. This channel when opened to navigation will be 13,300 feet long, 300 feet wide, and 22 feet deep below a slope of 579.3 to 578.8, with vertical sides in rock, and with stone retaining walls 6 feet above the low-water surface to mark the sides of the channel. The channel across the flats at the head of Mud Lake, 19,300 feet long, 300 feet wide, increasing to 900 at the angle, was completed in December, 1907, to a depth of 21 feet below 578.8. Two shoals in the Mud Lake channel were also removed under the contract for this section.

In the Middle Neebish channel the contract for deepening the channel leading from Mud Lake to Sailors Encampment was reported completed June 29, 1908, but an examination is necessary before the work can be accepted. Contracts have also been awarded for deepening the channels through the flats at the foot of Hay Lake and Middle Neebish rapids. About 80 per cent of the work proposed has been completed.

The funds on hand amount to $801,659.79 (+$46.13 expended for Isthmian Canal Commission), and $435,000 additional will be needed for work during the fiscal year ending June 30, 1910, for the prosecution of the authorized improvements.

For statistics of commerce and effects of channel improvements on freight rates, attention is invited to remarks on these subjects in report for operating and care of St. Marys Falls Canal, Michigan, and ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo.

MIDDLE AND WEST NEEBISH CHANNELS, ST. MARYS RIVER, MICHIGAN.

July 1, 1907, balance unexpended	$849,116.36
June 30, 1908, amount expended during fiscal year for works of improvement	668,257.13
July 1, 1908, balance unexpended	180,859.23
July 1, 1908, outstanding liabilities	88,073.75
July 1, 1908, balance available	92,785.48
July 1, 1908, amount covered by uncompleted contracts	25,000.00

HAY LAKE AND NEEBISH CHANNELS.

July 1, 1907, balance unexpended	$337,375.19
Amount appropriated by sundry civil act approved May 27, 1908	315,000.00
	652,375.19
June 30, 1908, amount expended during fiscal year for works of improvement	[a] 31,528.50
July 1, 1908, balance unexpended	620,846.69
July 1, 1908, outstanding liabilities	16,000.00
July 1, 1908, balance available	604,846.69
July 1, 1908, amount covered by uncompleted contracts	670,000.00
Amount (estimated) required for completion of existing project	435,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	435,000.00

(See Appendix O O 4.)

5. *Cheboygan Harbor, Michigan.*—This harbor is at the mouth of the Cheboygan River, where there was an available depth of 6 feet in 1870, when the first project for improvement was made. The original project called for a channel 200 feet wide and 14 feet deep, its sides to be protected by pile revetment and piers, and the estimated cost of the work was $395,335.

Operations under this original project were confined solely to dredging, which was carried to a depth of only 13 feet until 1880, when the first of a series of projects which had for their object the obtaining of a 15-foot channel was submitted, and as a result of the work which was carried on under projects submitted in 1880, 1882, 1887, and 1888 a 15-foot channel was secured from the 15-foot contour in the Straits of Mackinac to the State Road Bridge, having a width of 200 feet from the Michigan Central Railroad dock out into the straits and a width within the river available between piers. A turning basin, with clear 15 feet depth, was also provided in front of the steamboat docks.

There was expended on the original project $90,874.42, and $57,055.02 on the modifications begun in 1880.

Entrance to the channel is marked by a light-house on a crib 40 feet square, which was built in 1881.

The present project was adopted in 1895, and provides for dredging a channel 18 feet deep for a width of 200 feet from the 18-foot contour in the Straits of Mackinac to the outer end of the west pier and inside of that point between lines parallel to and 25 feet from the piers to the State Road Bridge. Operations under this project were begun in 1895, and by 1903 the projected channel had been completed to within 900 feet of the upper limit of the harbor, which section still remains to be dredged to complete the project.

[a] Actual expenditures during the fiscal year were $31,574.63, which amount includes $1,03 paid by Treasury Department, account of Duluth, South Shore and Atlantic Railway Company, and $46.13 chargeable to Isthmian Canal Commission for inspecting material; deducting this latter amount from the total expenditures, leaves $31,528.50 net expenditures.

The river and harbor act approved March 2, 1907, directed the extension of the improvement from the State Road Bridge to the lock in the Cheboygan River by a channel 8 feet deep and 60 feet wide, the estimated cost of which was $10,797.60.

Work on this extension of the channel began in October, 1907, and about 60 per cent of the channel had been completed at the close of the fiscal year.

The amount expended on the work of the existing project up to the close of the fiscal year ending June 30, 1908, is $37,092.13, none of which has been applied to maintenance. It is proposed to expend the balance upon the completion of the extension of the channel to the lock and for restoring channel depths wherever necessary.

The total length of the dredged channel from deep water in the Straits of Mackinac to the State Road Bridge is 7,900 feet, and from there to the lock is 3,820 feet. The maximum draft that can be carried over the shoalest part of the channel is 17 feet to a point within 900 feet from the State Road Bridge, 10 feet from that point to the bridge, and 8 feet from the bridge to a point nearly two-thirds of the distance from the bridge to the lock.

Above the lock the river is navigable through what is known as the "Inland Route," through Mullet Lake, Indian River, Burt Lake, Crooked River and Lake, a distance of 36 miles, for boats having a draft of from 4 to 5 feet.

The commerce of the harbor consists mainly of logs, lumber, and ties. It amounted to 593,768 tons during the year 1907, and was valued at $709,844. A number of large lake passenger steamers stop at this port during the summer months.

On account of the progressive nature of the improvement, the effect upon freight rates has been gradual, and the precise effect is therefore difficult of ascertainment, but there can be no doubt that during the season of navigation the existence of the deep-water harbor at Cheboygan has had a very decided effect on freight rates.

The Report of the Chief of Engineers for 1896 (pp. 2723, 2724) summarizes the history of operations to June 30, 1896, and the Report for 1895 (p. 2824) gives a map of the harbor.

Reports of examinations and surveys are given in the Reports of the Chief of Engineers, as follows: 1870, page 44; 1871, pages 183–186; 1880, page 2035; 1895, page 2825; 1897, page 2577; 1900, page 4012, and reference on page 664, report of 1906.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	155,898	285,189	1901	161,771	252,727
1894	76,554	227,346	1902	177,231	262,553
1895	110,062	216,868	1903	33,723	259,224
1896	163,362	362,011	1904	24,815	106,461
1897	147,255	293,161	1905	419,171	114,188
1898	366,332	334,636	1906	318,442	141,086
1899	152,689	352,214	1907	444,557	149,211
1900	44,237	59,536			

July 1, 1907, balance unexpended	$22,450.32
June 30, 1908, amount expended during fiscal year for works of improvement	8,971.89
July 1, 1908, balance unexpended	13,478.43
July 1, 1908, outstanding liabilities	927.82
July 1, 1908, balance available	12,550.61
July 1, 1908, amount covered by uncompleted contracts	4,464.18
Amount (estimated) required for completion of existing project	5,000.00

(See Appendix O O 5.)

6. Alpena Harbor (Thunder Bay River), Michigan.—The original depth of water over the bar at the mouth of the Thunder Bay River was only 7 feet. Local enterprise had secured a narrow channel 12 feet deep through the bar before work was undertaken by the Government in 1877, when, under the original project for the improvement of this harbor, act of August 14, 1876, a channel 13 feet deep and 200 feet wide was secured at a cost of $4,390.48. Shoaling having occurred, in 1882 $15,000 was appropriated for redredging the channel, and the project was modified so as to provide for an available depth of 14 feet. The work was completed the following year at a cost of $10,500, and $3,998.22 was expended in 1889 in redredging to 14 feet across the bar and 13 feet upstream. The amount expended on this project was $14,498.22.

In 1890 the present project was adopted so as to provide for a channel depth of 16 feet and the extension of the improvement up the river about a mile to the vicinity of the dam across the river at that point, with widths varying as follows: 200 feet at the 16-foot contour in Thunder Bay, thence tapering to 100 feet at the light-house crib, thence 100 feet to the Second Street Drawbridge, thence 75 feet to the Minor Lumber Company's wharf, thence 50 feet to the upstream limit of the channel improvement, the estimated cost being $36,087.48. This project was completed in 1893. The channel was redredged in 1899, and again in the summer of 1907, a 16-foot depth being provided with a width of 140 feet opposite the light-house, tapering to 100 feet at Second Street Bridge, and to 60 feet for a farther distance of 2,100 feet.

The amount expended on the work of the existing project to the close of the fiscal year ending June 30, 1908, is $36,201.30, of which amount $14,900.83 has been applied to maintenance.

The total length of dredged channel is 6,550 feet, a channel 2,250 feet long and 100 to 200 feet wide having been secured in Thunder Bay, and 4,300 feet long in the river, with widths varying from 100 feet at the light-house crib to 50 feet at the upstream limit of the improved channel. The maximum draft that can be carried over the shoalest part of the channel June 30, 1908, is 16 feet, as determined by channel soundings made June 9, 1908, the elevation of Lake Huron on that date being 581.65. The river is navigable to the upper limit of the improvement only, farther navigation being interrupted by the dam across the river at that point.

The appropriation recommended will be applied to maintenance of the harbor.

The commerce of the harbor consists mainly of lumber, cement, coal, cedar posts and ties, hay and feed, and general merchandise,

and amounted to a total of 585,519 tons during the year 1907, valued approximately at $3,969,673.

The effect of the improvement upon freight rates has been very beneficial, as it is estimated that freight and passenger rates have decreased almost one-half since the improvements were made.

A detailed report of operations to that date will be found in the Annual Report of the Chief of Engineers for 1891, pages 2765–2770, and a map showing the locality in the Annual Report for 1889, page 2290.

Reports of examinations and surveys are found in the following Reports of the Chief of Engineers: 1871, pages 158–159, and for 1876, page 106.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	51,600	308,988	1901	62,131	169,442
1894	102,700	363,291	1902	60,213	193,201
1895	35,957	269,203	1903	69,721	153,222
1896	94,067	255,687	1904	51,722	150,381
1897	78,378	293,161	1905	73,331	200,785
1898	60,300	236,075	1906	78,241	171,185
1899	27,888	197,725	1907	419,403	166,116
1900	51,653	263,702			

July 1, 1907, balance unexpended	$5,437.40
June 30, 1908, amount expended during fiscal year, for maintenance of improvement	5,027.40
July 1, 1908, balance unexpended	410.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	4,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix O O 6.)

7. *Saginaw River, Michigan.*—The Saginaw River has a length of about 22 miles, and is formed by the confluence of the Tittabawassee and Shiawassee rivers. Prior to improvement the entrance to the river was obstructed by a bar in Saginaw Bay, having a minimum depth of about 9 feet. Between the mouth and Bay City the depth varied from 15 to 30 feet. Thence to the head of the river the channel was obstructed by a number of bars, having 7 feet of water.

The original project for the improvement of this river was made in 1866, and contemplated a straight channel 195 feet wide and 12 feet deep across the bar at the mouth. This was completed in 1869. In 1874 the project was extended to include the improvement of the river above Bay City. It included dredging a 10-foot channel across the bars at East Saginaw and Carrollton, and the construction of a pile revetment at the latter place. Later, similar improvements at Zilwaukee bar, New York Works bar, and Willow Island were added. The cost of the work under this project was $219,000.

In 1882 the existing project was adopted, which provides for a channel 200 feet wide and 14 feet deep from Saginaw Bay to and along the front of Bay City, and thence a channel of same width, 12

feet deep, to the upper limits of the city of Saginaw. By the river and harbor act of August 5, 1886, the improvement of the west channel along West Bay City was also added to the project.

During the fiscal year ending June 30, 1907, dredging was done on the bars between Carrollton channel and Bay City, and along the water front of that city, and the result was the restoration of channel depths along this stretch of river.

During the fall months of 1907 a complete survey of the river from its mouth to the confluence of the Tittabawassee and Shiawassee rivers was made and contracts for the improvement entered into. At the close of the fiscal year work under the contracts was progressing fairly, and the channel should be completed this fall.

The amount expended on the existing project to June 30, 1908, is $622,036.80. In the past no attempt has been made to separate the cost of maintenance from that of original improvement, so that it is impossible now to separate these items.

The available balance will be expended for payments on contracts in force and for the necessary inspection and engineering. The appropriation recommended will be applied to redredging shoals which may form before 1910.

Saginaw River is navigable for a distance of 22 miles from the mouth.

The volume of commerce benefited by the improvement has been decreasing, having fallen from 1,945,033 tons in 1901 to 275,572 in 1907, this being due to the decrease in the lumber trade in the Saginaw Valley. The value of the commerce carried in 1907 is approximately $3,250,000, and it consisted mainly of lumber, coal, cement, and salt.

The precise effect of the improvement upon freight rates can not be stated. It is undoubted, however, that freight rates, both to Bay City and Saginaw, have been materially lowered by the existence of the improved channel.

More extended information can be found in the Annual Reports of the Chief of Engineers for 1883, pages 1858–1868; 1885, pages 2138–2150 (with maps); 1890, pages 2724–2729, and 1892, pages 2454–2464.

Reports of examinations and surveys are given in the Reports of the Chief of Engineers, as follows: 1866, page 59; 1867, page 146; 1872, page 207; 1874, pages 206–209; 1875, page 289; 1878, page 1234; 1882, page 2332; 1893, page 2928; 1894, page 2244; 1895, page 2829; 1898, pages 2579, 2600, and 2604.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	651,163	1,069,298	1901	1,250,292	694,741
1894	.....	1,108,307	1902	1,012,620	106,409
1895	391,751	347,146	1903	359,779	17,999
1896	471,106	240,496	1904	264,066	13,010
1897	995,960	354,860	1905	227,226	14,161
1898	1,126,891	364,561	1906	274,245	18,860
1899	728,629	311,547	1907	254,897	20,675
1900	482,253	402,827			

July 1, 1907, balance unexpended	$106,124.00
June 30, 1908, amount expended during fiscal year, for maintenance of improvement	4,408.96
July 1, 1908, balance unexpended	101,715.04
July 1, 1908, outstanding liabilities	10,066.44
July 1, 1908, balance available	91,648.60
July 1, 1908, amount covered by uncompleted contracts	82,721.41
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	50,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix O O 7.)

8. Sebewaing River, Michigan.—The original channel from Saginaw Bay to the mouth of the Sebewaing River had an available depth of scant 4 feet. The first improvement was made in 1875, under the original project of that year, when a narrow channel 6 feet deep was dredged from the 6-foot curve in Saginaw Bay to the mouth of the river, and some dredging was also done within the river itself, by which it was straightened and deepened to 6 feet, at a cost of $8,000.

The project was modified in 1880, and $7,000 appropriated for deepening the channel to 7 feet, the work being done in 1880–81.

The existing project, adopted in 1896, provides for dredging the entrance channel to a width of 100 feet and depth of 8 feet below the datum plane of the survey of 1895, the length of dredged channel to be about 15,000 feet; estimated cost $37,000; but no work was done until the appropriation of March 3, 1899, became available. Contract was made in 1899 to do the work, which was finished, as far as available funds permitted, September 9, 1903, and resulted in securing a channel of the required length and depth, but with widths varying from 70 to 90 feet throughout the distance covered. The amount expended on this improvement was $35,573.45.

An examination of the channel early this spring disclosed the fact that the formation of a bar at the mouth of the river, over which there was not more than 3 feet of water, had practically closed the river to navigation. Bids were invited for the removal of this bar, but the smallness of the sum available for the work, and the fact that a dredge would be at all times exposed to the storms of Saginaw Bay, as the depth of water would not permit its seeking shelter in the river, prevented any dredging firms from bidding. It is purposed to accomplish the work of removing the bar by a leased plant.

The amount expended on the work of existing project to the close of the fiscal year ending June 30, 1908, is $41,290.01, of which amount $5,716.56 has been applied to maintenance.

The available balance is required to maintain the existing improvement.

The maximum draft that can be carried June 30, 1908, at mean low water, over the shoalest part of the locality, is 6.5 feet. The river is navigable to the docks at Sebewaing.

The commerce affected by the improvement amounted in 1907 to 4,239 tons, and consisted mainly of lumber, gravel, fish, and coal. The effect of the project upon freight rates can not be definitely

stated, but information received from the largest local merchant is to the effect that the improvement has had a favorable effect upon freight rates generally and that the prospect is for an increased use of the harbor.

For reasons stated in his report the district officer does not consider this stream worthy of further improvement except for limited maintenance.

A map of the locality is given in the Annual Report of the Chief of Engineers for 1903, at page 1988.

Reports of examinations and surveys are given in the following Reports of the Chief of Engineers: 1873, pages 306, 307; 1875, page 290; 1879, page 170; 1880, page 2044; 1891, page 2804; 1893, page 2951, and 1895, page 2743.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1896	43,700	123,274	1902	33,500	44,750
1897	50,481	139,987	1903	14,405	29,910
1898	14,820	151,085	1904	14,770	30,500
1899	13,088	127,450	1905	4,700	4,850
1900	24,200	118,225	1906	5,740	4,075
1901	17,625	77,998	1907	3,827	412

July 1, 1907, balance unexpended	$2,744.14
June 30, 1908, amount expended during fiscal year for maintenance of improvement	34.15
July 1, 1908, balance unexpended	2,709.99
July 1, 1908, outstanding liabilities	440.00
July 1, 1908, balance available	2,269.99
July 1, 1908, amount covered by uncompleted contracts	2,122.50
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	2,000.00

(See Appendix O O 8.)

9. Harbor of refuge at Harbor Beach, Lake Huron, Michigan.—The site for this harbor, selected in 1872 by a Board of Engineer officers, is on the west shore of Lake Huron, 60 miles north of its outlet into the St. Clair River, and the artificial harbor built there since then is the only safe refuge on that coast from the foot of the lake to Tawas Bay, 115 miles above.

The work of construction was commenced in 1873 under a project providing for three separate piers, or breakwaters, of cribwork filled with stone, so located as to shelter a water area of some 650 acres on the north, northwest, and west sides, and for deepening this area by dredging where necessary. The estimated cost of the breakwaters was $1,452,550, and they were completed in 1885 at a cost of $970,716.40, including maintenance to that date.

The river and harbor act of March 3, 1899, provided for commencing the work of rebuilding the superstructure of the main pier in

concrete, and authorized the work to be inaugurated under the continuing-contract system to the extent of $200,000. It was not, however, until 1903 that a definite project for doing the work was decided upon, and the first contract was let in August of that year. The work was begun in June, 1904.

The river and harbor act of March 3, 1905, directed an examination to be made of the harbor, with a view to ascertaining what other further improvements were necessary, if any, in order to make such harbor of refuge suitable for the present demands of commerce. The report, which was submitted to Congress June 16, 1906, and printed as House Document No. 900, Fifty-ninth Congress, first session, recommended the continuation of the rebuilding of the superstructure of the main pier as begun, the rebuilding of the superstructure of the north and south piers in concrete, the protection of the main pier from wave shock by riprap, the closing of the north entrance to prevent the entrance of littoral deposit, and the dredging and deepening of the harbor to 21 feet and of the main entrance to 23 feet. The estimate for the work recommended was $970,000, with an added sum of $10,000 per year for maintenance and harbor police. By the river and harbor act of March 2, 1907, $150,000 was appropriated for continuing this work.

Under this plan for the repair and improvement of the harbor, work on the main pier has been carried on continuously, and at the close of the fiscal year ending June 30, 1908, 3,847 linear feet of the superstructure of the main pier had been completed, being 82 per cent of the entire length of the pier. The remaining work on the main pier superstructure will be completed this fall.

The total amount expended to the close of the fiscal year ending June 30, 1908, is $1,794,750.33, of which about $975,000 was applied to the first cost of the sheltering breakwaters, which were completed in 1885. Since that time there has been applied to maintenance $819,750.33, which includes the construction of concrete superstructure on main pier, the keeping of the wooden piers in repair, dredging within the harbor, control and berthing of vessels entering the harbor for shelter, and engineering supervision and general office expenses.

The available balance will be applied to payment for work under contract and to cover the cost of the necessary supervision of the harbor during the ensuing fiscal year; also to such repairs to the timber structures as may become necessary.

As a result of the expenditures made upon this harbor, there has been created an artificial harbor of refuge, which has been used for shelter during the past year by 882 vessels, with a total tonnage of 720,016 tons. The grand total of vessels that have found shelter from 1877 to 1907, inclusive, is 36,761, the tonnage of which aggregated 15,961,494. The vessels sheltered in 1877 averaged 289 tons each, and those during the year 1907 791 tons. The maximum draft that can be carried into the harbor through the main entrance, making allowance for the effect of moderate seas, is between 19 and 20 feet, and vessels having this draft may safely lie inside the main pier. The appropriation recommended will be applied to continuing reconstruction of the piers.

More extended information can be found in the Annual Reports of the Chief of Engineers for the following years: 1873, pages 292–298;

1877, pages 925–932 (with map); 1879, pages 1645–1648 (with map); 1881, pages 2270–2275; 1882, pages 2369–2372; 1885, pages 2151–2157; 1886, pages 1829–1836.

Reports of examinations and surveys are given in the following Reports of the Chief of Engineers: 1870, page 46; 1871, page 44; 1872, pages 209, 211, and 218; 1895, page 2832; 1896, page 2730; 1897, page 3016; and reference on page 664, report of 1906.

July 1, 1907, balance unexpended	$263,262.02
June 30, 1908, amount expended during fiscal year for maintenance of improvement	141,645.14
July 1, 1908, balance unexpended	121,616.88
July 1, 1908, outstanding liabilities	25,890.13
July 1, 1908, balance available	95,726.75
July 1, 1908, amount covered by uncompleted contracts	79,389.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	275,000.00

(See Appendix O O 9.)

10. Mouth of Black River, Rouge River, and Monroe Harbor, Michigan.—(*a*) *Mouth of Black River.*—An extensive bar and shoal exists in the St. Clair River adjoining the mouth of the Black. The bar lies close to the American side and formerly obstructed the approach to the Port Huron docks, while the shoal, forming a "middle ground" nearly 50 acres in extent, crowded the main channel in a sharp curve close to the Canadian shore.

The original project submitted in 1871 contemplated the removal of this bar and the middle ground to a depth of 15 feet, at an estimated cost of $67,320. The work was begun in 1872 and completed in 1878 at a cost of $56,500.

The present project contemplates dredging to a uniform depth of 16 feet along the dock front of Port Huron from the 16-foot curve above to the same curve below the mouth of the river. Work was begun in May, 1889, and finished in 1892, when authority was received to deepen the outer border of the shoal adjacent to the main channel to 18 feet, and the work was done. The amount expended on this work was $29,348.58. Operations since this time have been confined to maintenance, $12,008.31 having been expended for this purpose since the adoption of the present project to June 30, 1908. The last dredging was done in 1907, when the 16-foot depth was restored.

The available balance and the appropriation recommended will be applied to dredging such portion of the bar as may prove to be obstructive to navigation.

As a result of the work heretofore done, through navigation for vessels of moderate draft has been greatly facilitated, and entrance into the Black River proper has been rendered possible for this class of vessels. This, it is believed, has resulted in a reduction of freight rates, the extent of which could not be ascertained.

Reports of examinations and surveys are given in the following reports of the Chief of Engineers: 1871, pages 177–180; 1887, page 2279; 1899, page 2992; 1900, page 3986.

For receipts by vessel see "Black River at Port Huron" (p. 737).

July 1, 1907, balance unexpended	$6,426.85
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,783.74
July 1, 1908, balance unexpended	2,643.11
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *Rouge River.*—This stream originally had a channel depth of from 10 to 17 feet from its mouth to where the Wabash Railroad bridge crosses it, a distance of about 3 miles.

Under the provisions of the river and harbor act of August 5, 1886, a survey of the river was made and a project, dated August 25, 1888, prepared for securing a channel depth of 16 feet with a width of 240 feet for a distance of 800 feet from the mouth and thence with a width of 100 feet to the Wabash Railroad bridge. The estimated cost was $31,690.39. The work of improvement was commenced in 1888 and completed in November, 1892, at a cost of $30,272.79.

By joint resolution approved April 11, 1898, Congress authorized an extension of the improvement, with depth of 13 feet, up to the Maples road, a distance of about 1½ miles above the Wabash Railroad bridge, limiting the expenditure to $5,000. The river was dredged in 1900, the channel being made 50 feet wide.

The project for this river was modified by act of March 2, 1907, so as to provide an increase in depth from 16 feet to 21 feet between the mouth of the river and the first bridge, a distance of about 1,400 feet; estimated cost, $3,575.

During the season of 1907 the channel was deepened, in accordance with the amended project, to 21 feet, from the mouth to the Solvay Company's tunnel just below the Detroit connecting railroad bridge.

In addition to this work, the channel depth of 16 feet was restored to a point 11,550 feet above the mouth. The appropriation recommended will be applied to maintenance of the depth thus obtained.

The amount expended on the work of the existing project as amended to the close of the fiscal year ending June 30, 1908, is $66,160.96, of which $16,078.47 has been applied to maintenance.

At the completion of the dredging operations in the fall the result of the work had been to secure a channel of 21 feet, 240 feet wide, to the Solvay Company's tunnel, and a channel 16 feet deep, varying in width from 100 to 75 feet, from this point to a point 11,550 feet above the mouth.

The maximum draft that can be carried June 30, 1908, from the mouth to the Solvay tunnel is not over 17 feet, due to the formation

[a] See consolidated money statement on page 736.

of a bar this spring, from there to the Michigan Central Railroad Bridge 16 feet, between the Michigan Central Railroad Bridge and the Wabash Railroad Bridge 12 feet, and from there to Maples road not over 11 feet. The river is navigable for vessels of light draft to the town of Dearborn, 15 miles above the mouth.

The available balance will be applied to securing increased depths over the bar at the mouth of the river.

The receipts and shipments by vessel during the year 1907 amounted to 253,544 tons, of which 156,347 tons was iron ore, 45,522 tons lumber, and 40,000 tons pulp wood. The value of this commerce is about $1,479,443.

As a result of the improvement the area available for manufacturing plants in the vicinity of Detroit has been greatly extended, and these plants have been enabled to receive the raw materials which they use without transfer or transshipment. As a consequence the cost of the raw materials has been greatly reduced.

The channel banks of this river are low and ill-defined, and as not only the banks, but also the bed, are composed of soft material, deterioration of the dredged channel is very rapid. While therefore the growing importance of the industries which rely upon the use of this channel renders it desirable that funds for periodical dredging be provided, it also becomes necessary to demand that the owners of the riparian property, whose value is greatly enhanced by the improvement, shall be called upon to construct proper sand-tight docks. Without such provision recent experience shows that the channel is no sooner dredged than it at once begins to fill up from the material sucked into the channel by the propellers of passing vessels. While therefore the extent of the commerce demands additional depth in the lower portion of the channel, future appropriations should be coupled with the condition that no expenditure be made by the United States until the channel banks within the limits of the improvement have been properly docked.

The effect of the improvement has been to reduce freight rates 30 to 50 per cent for firms actually using dockage on the river.

Reference to report on examination ordered by the river and harbor act of March 3, 1905, will be found on page 664 of 1906 report. More extended information may be found in Annual Reports for 1890 (pp. 2747–2749); 1899 (p. 3013); 1901 (p. 3155). Reports on examinations and surveys, report for 1887 (p. 2275); 1898 (p. 2605).

Receipts and shipments by vessel, Rouge River.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	73,732	.....	1901	105,583	782
1894	47,106	.....	1902	56,701	10,000
1895	113,066	1,024	1903	125,272	10,000
1896	120,590	2,905	1904	242,861	6,898
1897	115,987	9,386	1905	284,140	.....
1898	117,486	10,259	1906	229,861	5,000
1899	92,631	763	1907	248,544	5,000
1900	119,712	4,600			

July 1, 1907, balance unexpended		$9,362.79
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$3,644.08	
For maintenance of improvement	5,189.67	
		8,833.75
July 1, 1908, balance unexpended		529.04
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		([a])
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(*c*) *Monroe Harbor.*—The harbor of Monroe, Mich., is within the mouth of the Raisin River at the western extremity of Lake Erie. In its natural condition the river flowed into the lake through several ponds and winding creeks. The depth of water at the deepest mouth of the river in its natural condition did not exceed 5 feet.

The original project for the improvement of Monroe Harbor was adopted in 1834. It had for its object to dredge a new and direct channel 100 feet wide and 10 feet deep from the lake across the marsh, a distance of 4,000 feet, to the portion of the river ordinarily used as a harbor, the protection of the entrance into the lake by parallel piers, 726 feet long and 20 feet wide, extending outward to a depth of 10 feet in the lake, and the protection of the sides of the canal by a revetment. The estimated cost of the work, exclusive of dredging machine, was $55,885. The work was practically completed in 1845, a depth of 9 feet being obtained to a point just below the docks at Monroe. Subsequently the city of Monroe further improved the river channel by cutting a canal about 1,300 feet long, 100 feet wide, and with a depth of from 13 to 16 feet, across a bend of the river. Subsequent operations consisted in repairing and extending the piers, repairing the canal revetment, and in dredging, by which a channel 200 feet wide and 13 feet deep, extending to deep water in the lake, was obtained.

In 1905 a double line of piling was driven connecting the south pier to the shore, to prevent the lake from breaking through into the canal, and some work was done in replacing rotten deck timbers.

The total amount expended on this work up to the close of the fiscal year ending June 30, 1908, is $254,839.19, of which $110,000 was applied under the original project. It is impossible to separate the portion of this total which has been applied to maintenance. During recent years practically all expenditures have been made for that purpose.

The available balance will be expended on repair of the decking of the piers and the replacing of a portion of the shore arm of the north pier by a pile pier about 120 feet long. This work began June 1, 1908, and is about 50 per cent completed at the close of the fiscal year.

The channel, beginning at the outer end, consists of the United States canal, 4,000 feet long, with an available depth of about 14 feet. Three thousand feet farther up the river the Monroe City ship canal begins. This has a length of 1,600 feet and a depth of 12 to 16 feet. From the upper end of this canal to the city wharves is 2,600 feet,

[a] See consolidated money statement on page 736.

with a depth of 10 to 12 feet. The stream is navigable from the lake to the docks at Monroe only, a distance of 2 miles.

This harbor can not accommodate the larger class of vessels used upon the lakes, and its commerce is not large, amounting in the year 1907 to 6,857 tons, valued at $50,000. Of this amount 6,250 tons was sand, the major portion of the balance consisting of fish.

The commerce of this stream is too small to have any effect whatever upon freight rates.

The Annual Report of the Chief of Engineers for 1880, pages 2083 to 2091, gives a detailed history of the operations up to that time.

Reports of examinations and surveys are given in the following Reports of the Chief of Engineers: 1866, page 29; 1868, page 145; 1872, pages 237–239; 1889, page 2338; 1893, page 3048; 1898, page 2689, and 1900, page 4020.

July 1, 1907, balance unexpended	$6,209.92
June 30, 1908, amount expended during fiscal year for maintenance of improvement	33.84
July 1, 1908, balance unexpended	6,176.08
July 1, 1908, outstanding liabilities	400.00
July 1, 1908, balance available	5,776.08
July 1, 1908, amount covered by uncompleted contracts	1,479.14
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([a])

CONSOLIDATED.

July 1, 1907, balance unexpended		$21,999.56
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$3,644.08	
For maintenance of improvement	9,007.25	
		12,651.33
July 1, 1908, balance unexpended		9,348.23
July 1, 1908, outstanding liabilities		400.00
July 1, 1908, balance available		8,948.23
July 1, 1908, amount covered by uncompleted contracts		1,479.14
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		15,000.00

(See Apendix O O 10.)

11. Black River at Port Huron, Michigan.—In 1888, when the original survey was made, the lower reach of the Black River, from its mouth to the Grand Trunk Railroad Bridge, 1½ miles in length, varied in width from 120 to 150 feet and had a depth of from 10 to 14 feet, except at a few points, where it was obstructed by bars having only 8½ feet of water over them. The improvement of this

[a] See consolidated money statement on this page.

stream was inaugurated by the river and harbor act of September 19, 1890, under a project which contemplated dredging to a navigable depth of 16 feet from the mouth to the Grand Trunk Railroad Bridge, with widths varying from 75 feet to 160 feet, at an estimated cost of $75,000. Operations were commenced in 1891 and the dredging was completed June 30, 1894, at a cost of $34,698.65, including an extension upstream of 1,800 feet to Washington avenue, authorized by the act of July 13, 1892. The total length of the dredged channel is 9,700 feet.

Since the completion of the project considerable dredging has been required to maintain the channel, particularly above the Grand Trunk Railroad Bridge, where experience and observation show that the narrow dredged channel has no degree of permanence.

The amount expended for maintenance to June 30, 1908, has been $17,674.06, making total expenditure since adoption of project $52,372.06.

As a result of the work done in this river a channel has been secured 16 feet in depth, with widths varying from 75 feet to 160 feet, extending from the mouth to the Washington Avenue Bridge, a total length of 9,700 feet. A channel with an available depth of 15 feet from the bar at the mouth to the Grand Trunk Railroad Bridge was found on June 6, 1908 (Lake Huron stage on date of soundings was 581.46), above that locality a depth of but 9.5 feet is reported. It is purposed to expend the available balance in partially restoring this section of the channel. For the maintenance of the entire channel annual dredging to the extent of $3,000 is required, and the appropriation recommended will be applied to this purpose.

There was received during the year 1907 168,152 tons of freight, valued approximately at $455,000. This consisted mainly of coal, gravel, lumber, and pulp wood.

The effect of the improvement has been to reduce freight rates upon approximately the number of tons received. It is doubtful whether this improvement has any indirect effect upon railroad rates.

More extended information will be found in the following Reports of the Chief of Engineers: 1893, pages 2938–2939; 1894, pages 2251–2252; 1898, pages 2586–2587.

Report of examination and survey is given in the Report of the Chief of Engineers for 1889, page 2292; reports of minor surveys, page 2993 of report for 1899, and page 3988 of report for 1900.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1893	175,081	7,487	1901	120,018	100
1894	116,535	4,413	1902	123,677	2,600
1895	104,850	6,825	1903	163,265	.....
1896	186,987	2,569	1904	197,044	.....
1897	96,925	1,455	1905	169,200	.....
1898	151,606	16,595	1906	135,695	.....
1899	130,675	37,368	1907	168,152	.....
1900	105,931	181			

July 1, 1907, balance unexpended	$6,015.60
June 30, 1908, amount expended during fiscal year, for maintenance of improvement	5,387.66
July 1, 1908, balance unexpended	627.94
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	6,000.00

(See Appendix O O 11.)

12. Operating and care of St. Clair Flats Canal, Michigan.—This canal consists of two dredged cuts through the St. Clair flats at the mouth of the St. Clair River. These cuts have a width of about 300 feet each, and depth of 20 feet, and extend into Lake St. Clair a distance of 17,460 feet. They are separated by a sand dike 100 feet wide, revetted by sheet piling for a distance of 7,221 feet, and the east cut is protected from wave wash and sand drift by a similar dike 50 feet wide.

An historical sketch of the improvement is given on page 2882 of the Annual Report of the Chief of Engineers for 1896, and a description of recent work is given on page 694 of the Annual Report of the Chief of Engineers for 1907.

The care and maintenance of the canal is provided for by the permanent indefinite appropriation for operating and care of canals and other works of navigation under the provisions of section 4 of the river and harbor act of July 5, 1884.

Operations for the past fiscal year were of the same routine character as those carried on since the opening of the canal to commerce. A custodian has been present during the year to enforce canal regulations and care for and repair the dikes.

The expenditure to June 30, 1908, was $169,001.76, excluding $456.23 estimated outstanding liabilities. The amount expended during the year is $9,094.81.

Freight traffic by calendar years:

	Freight tons.
1902	41,773,998
1903	41,888,134
1904	38,044,929
1905	51,359,071
1906	60,589,441
1907	66,271,962

For detailed information of commerce, see statistics appended to report of district officer for improving Detroit River, Michigan (Appendix O O 14). For effect of improvement on freight rates, see remarks in report on ship channel between Chicago, Duluth, and Buffalo (p. 717).

(See Appendix O O 12.)

13. Clinton River, Michigan.—This stream empties into Anchor Bay, in the northwesterly part of Lake St. Clair, and before improvement had a channel depth of about 10 feet, except at several shoals, over which but 5 or 6 feet could be carried, and a broad flat at the mouth with a general depth of 3 to 4 feet.

The first appropriation for the improvement of this river was made August 30, 1852, and from that time to 1886 occasional appropriations, amounting in all to $25,500, were made and expended on various dredging projects.

In 1889 a project for the general improvement of the river was adopted, to cover the entire river from the mouth to Mount Clemens, 8 miles upstream. This project called for an 8-foot channel, a pile dike extending across the flat at the mouth to the 10-foot curve in the bay, for revetments as needed above, and for closing the main channel and making a straight cut through Shoemakers bend. The estimated cost was $25,000, revised and amended in 1888 and 1889 to $34,564. The project was completed in 1893 with the expenditure of $34,546.26.

Since the completion of the project there has been $19,682.46 expended for maintenance, making the total expenditure since adoption of present project to June 30, 1908, $54,228.72.

The last work done on this river was in 1907, when channel depths were restored by dredging which was completed during the year. Periodical dredging is required for maintenance, and the appropriation recommended will be so applied.

As a result of the work done on this river, a channel 8 feet in depth has been secured from the mouth to the city of Mount Clemens, a pile dike has been built along the north side of the outer channel, and revetments have been built where needed in the river above. The present available depth throughout does not exceed 8 feet. The river is navigable for small boats a considerable distance above Mount Clemens. The effect of the improvement on freight rates can not be determined.

There were received and shipped during the year 1907, 24,306 tons of freight, consisting mainly of coal, logs, lumber, and sand. This is valued approximately at $143,411.

More extended information is given in the following Reports of the Chief of Engineers: 1893, pages 2942–2944, and 1894, pages 2254–2255.

Reports of examinations and surveys are given in the Reports of the Chief of Engineers as follows: 1872, page 214; 1876, Part 2, page 549; 1880, page 2062; 1885, page 332; 1895, page 2838; 1899, page 3001, and 1900, page 3996.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	Tons.	*Tons.*		*Tons.*	*Tons.*
1896	30,749	410	1902	33,868	.....
1897	29,077	.....	1903	28,411	.....
1898	29,085	.....	1904	22,878	257
1899	35,525	.....	1905	41,759	540
1900	32,410	282	1906	25,616	284
1901	36,925	.....	1907	23,273	1,033

July 1, 1907, balance unexpended	$7,252.31
June 30, 1908, amount expended during fiscal year for maintenance of improvement	6,417.03
July 1, 1908, balance unexpended	835.28
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix O O 13.)

14. Detroit River, Michigan.—Before improvement the shoalest part of the channel through Detroit River was at the Limekiln Crossing, where the normal depth was from 12½ to 15 feet over a bottom of solid rock.

The water surface, usually changing slowly, may rise or fall from a few inches during many days of calm weather to about 4 feet during severe storms and to about 6 feet during short, severe hurricanes, and the monthly mean may change as much as 2 feet in one year, or 4 feet in forty years.

The first project of 1874 provided for a winding channel of at least 20 feet in depth, over 300 feet in width; modified in 1883 so as to somewhat straighten such channel; in 1886 to give 400 feet width, and in 1888 to give 440 feet in width. The general depth above and below the Limekiln was 20 feet or more, but the bed of the river was studded with large bowlders and rocky shoals, which limited the safe navigable depth to scant 15 feet through a distance of about 12 miles. Accordingly the project was modified and extended in 1892 so as to provide for the removal of all obstructive shoals between the city of Detroit and Lake Erie, with a view to obtaining a through channel with a least width of 600 feet and a navigable depth of 20 feet, at a total estimated cost of $1,554,500, as adopted by river and harbor acts of July 13, 1892, and March 3, 1899, and as approved by the War Department at various dates from 1892 up to July 3, 1899. There has been expended on previous projects and modifications thereof $1,554,500.

The present project was adopted by the river and harbor act of June 13, 1902, which provides for a channel 600 feet wide and 21 feet deep from Detroit to Lake Erie. The estimate for the work was increased (see the final report of the survey directed by the act of March 3, 1899, in Annual Report of the Chief of Engineers for 1905, pp. 2292–2296) to $3,750,000, and in accordance with this increase the river and harbor acts of March 3, 1905, and March 2, 1907, authorized the continuation of the improvement to the extent of $700,000 in addition to the $1,750,000 originally authorized. All of this money has been appropriated, but there still remains to be provided for the work $1,300,000. On November 12, 1904, this project was modified to permit of slightly shifting the location of the proposed channel at Bar Point shoals, mouth of Detroit River, without increasing the cost.

The river and harbor act of March 2, 1907, modified the present project so as to provide for two channels—one for downbound, the other for upbound vessels, past Bois Blanc Island. The second channel, called the Livingstone channel (plan B of the report on survey), is to have a least width of 300 feet out to Bar Point, and 800 feet thence to deep water in Lake Erie, with a least depth of 22 feet. Work on this channel is authorized under continuing contracts to the extent of $6,670,950, of which $4,095,950 is yet to be appropriated.

More extended information may be found as follows: Annual Reports of the Chief of Engineers for 1891, pages 2794–2801 (special history); 1896, page 2758 (map), and 1904, pages 3140–3148; also House Document No. 160, Fifty-eighth Congress, second session (main channel to Wyandotte, Mich.), and House Document No. 266, Fifty-ninth Congress, second session (ship channel connecting waters of the Great Lakes).

During the fiscal year work has been prosecuted along Limekiln Crossing range, Bois Blanc range, Amherstburg reach, Hackett range, and Bar Point shoals in the Amherstburg channel, and under four separate contracts, each covering one of the four sections of the Livingstone channel. About 60 per cent of the work of improving the Amherstburg channel has been completed and 9 per cent of the Livingstone channel.

There has been expended to June 30, 1908, on the channel now designated as Plan "A," $3,697,017.71, of which amount $2,142,517.71 was applied to the present project adopted in 1902. The amount expended for Livingstone channel is $513,818.90. None of these funds have been applied to maintenance. Upon the completion of the work now under contract and in progress on the channel via Amherstburg, that part of the project will be completed, except for the sections along Ballards reef and Bar Point shoals. The work along Ballards reef can not be advantageously done until the completion of the entire Livingstone channel, but as section 4 of the Livingstone channel will be practically completed at the end of the present season of navigation and thrown open to commerce early in 1909, it is believed that the work on the Amherstburg channel in this vicinity, the Bar Point section, can be very advantageously undertaken at that time, and that $250,000, in addition to available balance, can be profitably expended for this work by June 30, 1910. There has been appropriated $2,575,000 for the Livingstone channel, and $2,500,000, in addition to available balance, can be profitably expended to June 30, 1910.

The greatest draft which can be carried over the improved channels June 30, 1908, was 21.54 feet, but this is subject to change considerably, the mean monthly stage for November, 1907, having been 18.88 at this place—Ballards reef.

For effect of channel improvements on freight rates, see remarks under this head in report of ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo.

GENERAL IMPROVEMENT.

July 1, 1907, balance unexpended	$666,650.80
Amount appropriated by sundry civil act approved May 27, 1908	150,000.00
	816,650.80
June 30, 1908, amount expended during fiscal year for maintenance of improvement	[a] 509,168.51
July 1, 1908, balance unexpended	307,482.29
July 1, 1908, outstanding liabilities	46,724.00
July 1, 1908, balance available	260,758.29
July 1, 1908, amount covered by uncompleted contracts	108,623.00
Amount (estimated) required for completion of existing project	1,300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897.	250,000.00

[a] Actual expenditures during the fiscal year were $509,220.28, from which amount $0.77 (refundment) and $51 (proceeds of sale) have been deducted, leaving the net expenditures $509,168.51.

LIVINGSTONE CHANNEL.

July 1, 1907, balance unexpended	$2,000,000.00
Amount appropriated by sundry civil act approved May 27, 1908	575,000.00
	2,575,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	[a] 513,818.90
July 1, 1908, balance unexpended	2,061,181.10
July 1, 1908, outstanding liabilities	256,684.00
July 1, 1908, balance available	1,804,497.10
July 1, 1908, amount covered by uncompleted contracts	5,116,028.00
Amount (estimated) required for completion of existing project	4,095,950.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of July 4, 1897.	2,500,000.00

CONSOLIDATED.

July 1, 1907, balance unexpended	$2,666,650.80
Amount appropriated by sundry civil act approved May 27, 1908	725,000.00
	3,391,650.80
June 30, 1908, amount expended during fiscal year for works of improvement	1,022,987.41
July 1, 1908, balance unexpended	2,368,663.39
July 1, 1908, outstanding liabilities	303,408.00
July 1, 1908, balance available	2,065,255.39
July 1, 1908, amount covered by uncompleted contracts	5,224,651.00
Amount (estimated) required for completion of existing project	5,395,950.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[b] 2,750,000.00

(See Appendix O O 14.)

15. Removing sunken vessels or craft obstructing or endangering navigation.—The following obstructions were completely removed during the fiscal year:

Steamer *Linden*, from channel in St. Clair River, Michigan; expense incurred for inspection, $1.25.

Wreck near Thunder Bay Island, Lake Huron; total cost, $1,000.

Wreck of schooner *Montpelier*, from Detroit River, near the lower end of Belle Isle; total cost, $800.

Wreck of schooner *Albany*, from channel in Belle River, Michigan: total cost, $445.73.

The wreck of the steamer *Eliza H. Strong*, in Lake Huron, off Lexington, Mich., was partially removed by the underwriters, and it

[a] Includes $5,833.33 transferred by Treasury Department to appropriation for "Survey of Northern and Northwestern Lakes," for sweeping raft.

[b] Of this amount $2,500,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907.

is expected that they will complete the work. Cost of examination of wreck, $57.97.

The steamer *Fred Pabst*, sunk in the St. Clair River, opposite Fort Gratiot, as a result of a collision, was subsequently raised and taken to dock at Sarnia, Ontario. Expense incurred for examination and patrol duty, $150.

(See Appendix O O 15.)

EXAMINATIONS AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and survey required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of Au Sable River, Michigan.—Report dated May 29, 1907, is printed in House Document No. 71, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

2. Preliminary examination and survey of channel between Russell Island and Grand Point, St. Clair River, Michigan.—Reports dated April 22 and November 26, 1907, respectively, are printed in House Document No. 453, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $100,000 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE CLEVELAND, OHIO, DISTRICT.

This district was in the charge of Lieut. Col. C. McD. Townsend, Corps of Engineers, to February 29, 1908, and of Lieut. Col. John Millis, Corps of Engineers, since that date. Division engineer, Col. G. J. Lydecker, Corps of Engineers, to November 15, 1907, Col. Charles E. L. B. Davis, Corps of Engineers, from November 15, 1907, to February 15, 1908, and Lieut. Col. W. L. Fisk, Corps of Engineers, since February 15, 1908.

1. Toledo Harbor, Ohio.—The harbor of Toledo is in the Maumee River. The wharf frontage on the river extends over a distance of about 3 miles, the lower end of which is about 4 miles above the mouth of the river, at the head of Maumee Bay.

Originally, in the bay, the least depth was 8.5 feet with a prevailing depth of 12 feet, while in the river the minimum depths were 14 feet.

In 1866 a project was adopted to dredge the channels of deepest water in the bay to a depth of 12 feet. The project was amended from time to time until 1887, when the old indirect channel had a minimum depth of 15 feet.

In 1887 a project was adopted for a straight channel through Maumee Bay, with a depth of 17 feet and a bottom width of 200 feet. The estimated cost, including dikes or other channel protections, was $1,875,000.

The project for a straight channel was amended in 1893 by increasing the width of outer section, about 3 miles long, to 300 feet. Since

1892 the improvement has been extended to include the Maumee River.

The total amount expended on original and modified projects prior to operations under existing project is $1,617,695.45.

The present project was adopted by the river and harbor act of March 3, 1899, and is described in the Report of the Chief of Engineers, 1898, pages 2693 to 2705, inclusive. It provides for a channel in the bay and river 400 feet wide and 21 feet deep to Fassett Street Bridge, and 200 feet wide and 21 feet deep for the section above the bridge, with a turning basin 500 feet wide at the upper end. A dike was also to be constructed 1,000 feet in length between the range lights in the bay. The estimated cost of the work was $1,005,000. A continuing contract was authorized for its execution, the limit of cost being fixed at $950,000.

The work contemplated by this project has been completed with the exception of the channel and basin above the Fassett Street Bridge, which has a width of only 100 feet.

The total expenditure under the existing project to the close of the fiscal year ending June 30, 1908, was $903,022.75.

The deepening of the bay to the Wheeling and Lake Erie Railroad bridge has been done under contract, and the deepening of the river above by the U. S. dredge *Maumee*. The dredging under this contract was completed October 9, 1905, a total of 5,854,456 cubic yards having been removed.

During the past year the U. S. dredge *Burton* excavated 20,549 cubic yards from the Maumee River between Magnolia and Ash streets and 381,979 cubic yards from the inner division of the straight channel, at a field cost of $26,356.67 for the maintenance of the channel. On June 30, 1908, the maximum draft that could be carried over the shoalest portion of the channel was 20 feet.

The result of these expenditures has been to create and maintain a channel through Maumee Bay and River 400 feet wide and 20 feet deep to Fassett Street Bridge, a distance of 15 miles, and to a width of 100 feet and depth of 20 feet for 1 mile above this bridge. The Maumee River is also navigable for vessels of 6-foot draft to Perrysburg, 15 miles above the mouth.

The appropriation recommended will be applied toward maintenance of existing channel to make the improvement available.

The usual variations in the level of the water surface during the season of navigation range from 1 foot above to 2 feet below mean lake level. Extreme fluctuations, due to wind, of 7.9 feet above to 7.1 feet below mean lake level have, however, been observed at Toledo.

There has been a marked reduction in freight rates since the project was inaugurated, but this has been due not only to the work at this particular harbor, but to that at the other harbors along the lakes and the improvements in the connecting channels, as well as to other causes, and it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce of Toledo for the calendar year 1907 amounted to 5,077,875 tons, an increase of 555,595 tons over that reported for the calendar year 1906.

Reference to reports on examination and survey, made in compliance with act of March 2, 1907, will be found on page 761 of this report.

July 1, 1907, balance unexpended	$113,626.93
Receipts from sales	41.25
	113,668.18
June 30, 1908, amount expended during fiscal year for maintenance of improvement	40,576.38
July 1, 1908, balance unexpended	73,091.80
July 1, 1908, outstanding liabilities	2,745.80
July 1, 1908, balance available	70,346.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	45,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P P 1.)

2. Port Clinton Harbor, Ohio.—The harbor of Port Clinton is within the mouth of the Portage River. This river flows into Lake Erie at a point about 13 miles by land and 22 miles by water west of the city of Sandusky. In its natural condition the depth of water on the bar at the mouth of the river rarely exceeded 5 feet.

The original project for its improvement was adopted in 1871 and was slightly modified in 1872 and 1873. It provided for the construction of two parallel jetties extending outward from the mouth of the river to a depth of 10 feet in the lake, at an estimated cost of $90,000. These were built of timber and stone.

The jetties were extended to a depth of 10 feet in the lake in 1883, at which time the east jetty had been extended 2,180 linear feet and the west jetty 1,948 linear feet. These lengths were found ample for the requirements of this harbor, and in 1894, at which time a total expenditure of $76,000 had been made, it was recommended that the remainder of the estimated cost of executing the project ($21,000) be expended for necessary repairs.

The project since 1894 has been one for maintenance, under which $27,999.29 has been expended.

The result of these expenditures has been to produce a channel 11.3 feet in depth, extending for one-half mile above the mouth of the Portage River, which was the maximum draft that could be carried June 30, 1908. A channel of 6 feet depth extends to Oak Harbor, 12 miles above the mouth of the river.

The appropriation recommended will be applied to repair of piers and dredging for maintenance to keep the improvement available.

The project has had little effect on freight rates, as the commerce of the port is small.

Under the appropriation of $3,000 made by the river and harbor act of March 2, 1907, for maintenance, a contract was let for continuing the repair and reenforcement of the jetties. Work under this contract was completed March 26, 1908.

The commerce of Port Clinton for the calendar year 1907 amounted to 10,851 tons, a decrease of 1,079 tons from that reported for the calendar year 1906.

July 1, 1907, balance unexpended	$3,000.00
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,999.29
July 1, 1908, balance unexpended	.71
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	2,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P P 2.)

3. Sandusky Harbor, Ohio.—The harbor of Sandusky is in the lower part of Sandusky Bay, along the city front, the part nearest to the lake being about 2 miles from the bar which divides the waters of the bay from those of the lake. In its natural condition the depth was only such as the bay afforded, which was about 10 feet along the city front and from 9 to 12 feet thence to the lake.

A long, flat sand bar divided the bay from the lake, this bar being cut through by a channel from 1,000 to 2,000 feet in width near its central portion. The southern part of the bar is called "Cedar Point" and the northern "Sand Point." Between these two points the currents between the bay and the lake had scoured out the channel to a depth of not less than 18 feet for a distance of a mile or more.

The first appropriation was made for a survey in 1826 and the first improvement was made in 1844, consisting in the construction of a dam to close a breach across Sand Point. With this exception, all the improvements made previous to 1896 consisted in deepening natural channels and in making a new straight channel from the city front to Cedar Point and in removing sand and bowlders from the dock channel along the city front. Natural causes since 1826 have washed away a greater part of Sand Point.

In 1896 and subsequently the project was added to so as to provide for the construction of parallel jetties of stone upon mattress foundations extending from Cedar Point and Sand Point outward, with a view to confining and directing the flow of water to and from the bay. Provision was also made for the construction of certain spurs and mattresses for the protection of the channel near Cedar Point and at the point of the bar near the light-house.

Under the original project thus modified there was expended $476,749.09.

The present project, authorized by the river and harbor act of March 3, 1899, is described in the Annual Report of the Chief of Engineers for 1898, pages 2708 to 2716, inclusive. It provides for a jetty of stone upon brush mattresses extending from Cedar Point about 5,000 feet into the lake; for a west jetty 5,550 feet long on the opposite side of the channel, about 750 feet distant; for the protection of the crest of the bar and shore of Sand Point with a low dam of brush and stone, and for a deflecting dike for inner bar 1,500 feet long, and dredging to 17 feet. The estimated cost was $425,796, of which $317,796 was for permanent works. By the river and harbor act of June 13, 1902, the project was modified so as to provide for dredging a channel 21 feet deep at mean lake level with a width of 400 feet in the approaches to the harbor front and 300 feet in the harbor channel, at an estimated cost of $781,000, as described in the

Report of Chief of Engineers, 1901, pages 3270 to 3277, inclusive. The estimated cost of the entire project as revised in 1903 was $1,135,000.

The act of March 3, 1905, modified the project by omitting therefrom the excavation of rock other than that already provided for by contract in the dock channel and fixed the limit of expenditures at $815,000. Continuing contracts in excess of cash appropriations were authorized by the same act to the amount of $480,000, of which $130,000 remains to be appropriated. The act of March 2, 1907, restored this work of rock removal to the project and appropriated $125,000 for maintenance and continuing the improvement. In the interim the city of Sandusky had removed considerable rock from the channel and the remaining rock can be removed with the funds appropriated for the purpose.

The total expenditures under the present project for improving Sandusky Harbor to June 30, 1908, is $534,026.08, of which amount $24,675.46 was for maintenance during the past four years. Prior to that time the amount expended for works of improvement and for maintenance was so involved that it would be impracticable to separate them.

Under the authorization contract for dredging during the fiscal year, 277,176 cubic yards of material in the straight channel and dock channel was removed. A total of 1,964,867 cubic yards of material was removed, this contract being completed October 1. Under the appropriation of $125,000 in the river and harbor act of March 2, 1907, a contract is in force, and operations are being carried on for continuing the rock excavation in the dock channels. The excavation of the channel through the outer bar, being in an exposed locality, is to be done by the Government hydraulic dredge.

During the past year, under the new contract, there has been removed 14,081 cubic yards of earth and rock from the inside channels. A considerable portion of the rock excavation from the west dock channel was deposited in the extension of the east jetty, where it could be used for building up this jetty. The U. S. dredge *Maumee* worked at Sandusky from July 1 to August 19, and cast over stone on this jetty for a distance of 1,305 feet.

The result of these expenditures has been to create a channel 300 feet wide and 20 feet deep through the outer bar, 400 feet wide and 20 feet deep to the city front, and 200 feet wide and 18 feet deep along the city front to the Short Line docks, completing 36.1 per cent of the work now under contract. The project as a whole is regarded as about 64 per cent completed.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

There is a general depth of 10 feet in Sandusky Bay to the mouth of the Sandusky River, 14 miles above the city, and of 8 feet in the river to Fremont, Ohio, 18 miles above its mouth. The usual variation in the level of the water surface is the same as at Toledo, with extreme fluctuations of 5 feet above and below mean lake level.

The receipts and shipments at the harbor of Sandusky for the calendar year 1907 amounted to 2,239,861 tons, an increase of 873,198 tons from that reported for the calendar year 1906.

July 1, 1907, balance unexpended	$381,764.86
June 30, 1908, amount expended during fiscal year for works of improvement	100,348.03
July 1, 1908, balance unexpended	281,416.83
July 1, 1908, outstanding liabilities	3,882.10
July 1, 1908, balance available	277,534.73
July 1, 1908, amount covered by uncompleted contracts	59,020.70
Amount (estimated) required for completion of existing project	135,000.00

(See Appendix P P 3.)

4. Huron Harbor, Ohio.—This harbor is situated at the mouth of Huron River. In its natural condition the entrance was practically closed by a sand bar.

The first project for its improvement was adopted in 1826 and provided for the construction of two parallel jetties 140 feet apart, extending outward from the river banks. These jetties were lengthened from time to time and repaired as required, and the channel was finally deepened by dredging.

The total amount expended upon these projects for all purposes of construction and maintenance to June 30, 1905, was $269,908.95.

The present project for the improvement of this harbor was authorized by the river and harbor act of March 3, 1905. It is based upon a survey, plan, and estimate called for by the river and harbor act of June 13, 1902, and is published in full in the Report of the Chief of Engineers for 1904, pages 3209 to 3218, inclusive.

This plan utilizes all that portion of the west jetty which is serviceable, rebuilds 580 linear feet, and extends the jetty 240 feet and terminates it at its outer extremity in a pierhead 50 feet square. A new east jetty is also constructed, consisting of a pierhead of the same dimensions as that on the west jetty and 300 feet easterly from it. From the pierhead a new jetty of rubble-mound type extends to a point on the shore 1,200 feet distant from the channel. The channel and a part of the sheltered area are to be dredged to a depth of 21 feet and the old east jetty is to be completely removed. The pierheads, 340 linear feet of the old west jetty, and the new jetty construction are to be capped with concrete. The total estimated cost of the work is $315,500.

In the spring of 1904 it was necessary to make an allotment of $40,000 from the river and harbor act of April 28, 1904, for the maintenance of this harbor. This money has been expended in rebuilding about 490 linear feet of the shoreward end of the west jetty, which was in such a ruinous condition that it threatened to give way and to involve the destruction of the channel. This extension directly advanced the project and diminished proportionally the amount required for its completion.

The river and harbor act of March 3, 1905, appropriated $68,500 and authorized contracts to be entered into for $200,000 more for the completion of the new projects. Of this latter sum all but $3,000 has now been appropriated.

With the funds appropriated by the river and harbor act of March 3, 1905, the crib foundation of two pierheads and two 123-foot by 24-foot substructure cribs in the extremity of the new jetty were completed.

Work was completed May 19, 1908, on a contract for building concrete superstructure on 582 linear feet of the west pier and on two pierheads at the harbor entrance; also to construct a rubble-mound jetty on the east side of the harbor entrance 1,800 feet long.

The excavation necessary in connection with the execution of the project and for maintenance of channel has been done by the U. S. dredges *Maumee* and *Burton*.

The amount expended under the existing project to June 30, 1908, was $231,576.34, of which amount $43,791.10 was for maintenance.

The result of these expenditures has been to obtain a channel 200 feet wide and 20 feet deep at mean low water through the outer bar and jettied channel for a distance of three-fourths of a mile. The project is regarded as 97 per cent completed.

A channel 8 feet deep extends to Milan, 8 miles above the mouth. The water-surface variations are similar to those at Sandusky Harbor.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce of Huron Harbor for the calendar year 1907 amounted to 2,321,455 tons, an increase of 646,359 tons over that reported for the calendar year 1906.

July 1, 1907, balance unexpended	$175,864.12
Receipts from sales	.74
	175,864.86
June 30, 1908, amount expended during fiscal year for works of improvement	118,549.77
July 1, 1908, balance unexpended	57,315.09
July 1, 1908, outstanding liabilities	1,876.91
July 1, 1908, balance available	55,438.18

(See Appendix P P 4.)

5. Vermilion Harbor, Ohio.—Vermilion Harbor is at the mouth of Vermilion River, which empties into Lake Erie about 20 miles eastward from Sandusky.

The improvement of this harbor was first undertaken in 1836, when an appropriation of $10,000 was made for the purpose. The original project provided for parallel jetties extending outward to 12 feet of water in the lake. The jetties were built, but the current only sufficed to maintain a channel of about 7 feet depth across the bar. In the natural condition of the harbor there was only about 2 feet of water at this place. Dredging was accordingly resorted to and the project enlarged to provide for a depth of 14 feet of water. This involved the removal of rock, and the project was never fully executed.

The total amount of money expended on the original project is $133,277.55.

The only work now proposed is the maintenance of existing jetties in a durable and permanent manner, the timber superstructure to be removed down to the level of the water, the side walls of the cribs to be reenforced by a riprapping of heavy stone having a slope of 1 on 1½; these slopes to be carried up above the surface of the water so as to give the jetty a height of 5 feet; above water the heavy stone protection to be laid in the form of a pavement. The estimated cost of this work is $42,350.

Under the appropriation of $15,000 in the river and harbor act of March 2, 1907, for maintenance, a contract was awarded for completing the reenforcement and repair of the west jetty and so much of the east jetty as the funds available would permit. Work under this contract was completed December 20, 1907.

The amount expended on the existing project for maintenance to June 30, 1908, was $29,844.18.

The result of these expenditures has been to provide a channel 12 feet deep to the inner end of the piers. A channel of 8 feet extends to the Lake Shore Railway bridge, one-half mile above. The water-surface fluctuations are similar to those at Huron or Lorain.

The appropriation recommended will be applied toward maintenance and repair of piers to keep the improvement available.

The improvement has had little effect on freight rates, as the tonnage of the port is small.

The receipts and shipments for the calendar year 1907 amounted to 1,609 tons, an increase of 584 tons from that reported for the calendar year 1906.

July 1, 1907, balance unexpended	$15,124.44
June 30, 1908, amount expended during fiscal year for maintenance of improvement	14,968.62
July 1, 1908, balance unexpended	155.82
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	500.00

(See Appendix P P 5.)

6. Lorain Harbor, Ohio.—This harbor is within the mouth of Black River, where it enters Lake Erie, 25 miles west of Cleveland. In its natural condition the depth of water at the mouth of this river did not exceed 3 feet, but the river itself was navigable for a distance of 3 miles from its mouth for all vessels then in use upon the lake.

The first project, adopted in 1828, provided for the construction of parallel piers 200 feet apart, running out to a depth of 16 feet in the lake. This project was modified in 1873 and 1880. The piers have had to be rebuilt and extended from time to time, so as to keep pace with increasing requirements, and dredging has been resorted to to secure a greater depth than the natural currents would afford. The amount expended on this project was $292,204.77.

The present project was adopted by the river and harbor act of March 3, 1899. The project in detail is given in full in the Annual Report of Chief of Engineers for 1898, pages 2718 to 2724, inclusive. It provides for the construction of two rubble-mound breakwaters converging toward the lake, having an opening between them at their outer extremities 500 feet in width and in prolongation of the axial line of the jettied channel. It also provides for repairing or rebuilding the jetties and for dredging the protected areas to a depth of 20 feet. The estimated cost is $695,500.

The total expenditure authorized by the river and harbor act of March 3, 1899, was $650,000, but that amount not being sufficient to secure the completion of the work at such prices as could be obtained

by advertisement special authority was given in the river and harbor act of June 6, 1900, to enter into contract for such portion of the work as the funds available would allow, at a cost not to exceed a 10 per cent increase over the original estimates, and the funds required therefor were appropriated in the river and harbor act approved March 3, 1905, and sundry civil acts of March 3, 1905, and June 30, 1906. The act of March 2, 1907, authorized the expenditure of $15,000 in dredging the easterly side of Black River from the inner end of the easterly Government pier to East Erie Avenue Bridge.

There has been expended under the new project to June 30, 1908, $616,958.76, of which amount $23,297.03 was for maintenance during the past five years. Prior to that time the amounts expended for works of improvement and for maintenance were so involved that it would be impracticable to separate them.

With this expenditure a channel has been dredged to a depth of 20 feet between the piers and for 1,000 feet beyond. Under a continuous contract 365 feet of the west pier and all of the east pier (1,765 linear feet) have been rebuilt with concrete superstructure. The substructure cribs of both pierheads at the new harbor entrance are in place, and the concrete superstructure of west pierhead has been completed. The west breakwater has been completed. The east breakwater has been completed for 1,400 feet and built up to — 8 feet for the remaining 100 feet.

Under a contract for the repairs of the west pier the timber superstructure for 638.5 feet has been replaced by concrete. This work, with that done under the continuous contract, completed the reconstruction of the west pier for its entire length (1,003.5 feet).

The U. S. dredge *Maumee* with plant was engaged from August 19 to August 26 in removing a dump scow; from August 26 to October 6 in dredging inner end of jettied channel, removing 20,183 cubic yards; and from October 7 to December 7 in dredging the easterly side of the Black River from the inner end of the Government pier to the East Erie Avenue Bridge, under a project approved March 27, 1907, removing 41,601 cubic yards of material at a field cost of $4,095.63.

The project is now 90 per cent completed. A channel of 20 feet depth also extends up the river to the steel plant, 3 miles above the mouth, and is maintained by local authorities.

The water-surface fluctuations are similar to those at Cleveland.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce of Lorain for the calendar year 1907 amounted to 5,230,420 tons, an increase of 904,729 tons over that reported for the calendar year 1906.

The U. S. dredge fleet *Maumee* was engaged during a part of the fiscal year in dredging the easterly side of the Black River between the inner end of the Government pier and the East Erie Avenue Bridge, causing the removal of 41,601 cubic yards. This work is now 30 per cent completed.

Reference to reports on examination and survey made in compliance with act of March 2, 1907, will be found on page 761 of this report.

July 1, 1907, balance unexpended		$262,412.75
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$98,795.39	
For maintenance of improvement	9,496.52	
		108,291.91
July 1, 1908, balance unexpended		154,120.84
July 1, 1908, outstanding liabilities		5,207.56
July 1, 1908, balance available		148,913.28
July 1, 1908, amount covered by uncompleted contracts		119,238.09

(See Appendix P P 6.)

7. Cleveland Harbor, Ohio.—The old harbor of Cleveland was originally entirely within the mouth of the Cuyahoga River, where the natural depth of the water was sufficient for the requirements of the time. The mouth of the river was obstructed by an extensive sand bar, across which a channel of varying location and uncertain depth existed. Sometimes the mouth of the river would be entirely closed by the action of the waves and would remain so until a freshet in the river cut out a new entrance.

The first improvement was undertaken in 1825, and the plan contemplated straightening the channel so that it would lead more directly into the lake, and making the new location permanent by jetties to confine the water and concentrate the action of the current upon the bar. These jetties were built, repaired, extended, and, in part, rebuilt, and the channel was made deeper and maintained by dredging as necessity required; but there was no change in the general plan of improvement until 1875, at which time the total expenditure had been $346,881.61.

In 1875 a project was adopted for a breakwater of timber cribs in 5 fathoms of water. The west breakwater was commenced in 1876 and completed in 1883, a total length of 7,130 feet. The east breakwater was commenced in 1888 and continued at intervals until 1893, when its length was 2,494.5 feet. In 1895 an opening of 200 feet was made in the shore arm of the west breakwater as a sanitary measure.

In 1896 Congress authorized the completion of the improvement at a total estimated cost not to exceed $1,354,000, in accordance with a project published in Annual Report of the Chief of Engineers for 1896, pages 2949 to 2953, inclusive. This project involved the completion of the east breakwater, covering an extension of about 3,000 feet; removing superstructure of the old west breakwater to a depth of 2 to 3 feet below water level and replacing it with a superstructure of concrete masonry; reenforcing the cribs below the masonry; sheathing the face of the east breakwater; removing and rebuilding the east and west piers and widening the mouth of the river. A continuous contract for the work was authorized.

In 1899 a project was prepared, and was authorized by the river and harbor act of that year, for deepening the channel and sheltered area by dredging to a depth of 21 feet. This project was enlarged by the act of June 13, 1902, to permit the dredging to be carried to a depth of 25 feet. The estimated cost of the work was $478,400. (See Annual Report of the Chief of Engineers for 1899, pp. 3076 to 3078, inclusive, for project, and p. 3061 for estimate as revised.)

The river and harbor act of June 13, 1902, authorized a further modification of the project by providing for improving and enlarging

the entrance to the harbor and for extending the breakwater eastward to Gordon Park, in the city of Cleveland, a distance of about 16,000 feet, at a total estimated cost of $4,481,456. This project is described in the Annual Report of the Chief of Engineers for 1901, pages 3277 to 3299, inclusive. The act authorized an expenditure of $2,800,000, of which $262,500 is yet to be appropriated, but this authorization was increased by $900,000, of which $775,000 is yet to be appropriated, in the river and harbor act of March 2, 1907, which also appropriated $98,000 for the construction of a Government dock at the foot of Erie street in the city of Cleveland, in accordance with plan printed in House Document No. 270, Fifty-ninth Congress, second session, contingent upon the consent of the Cleveland Yacht Club, which holds a lease of this frontage.

The existing project for improving Cleveland Harbor, Ohio, is therefore a combination of those authorized by the acts of 1875, 1896, 1899, 1902, and 1907.

There has been expended on this project to June 30, 1908, $5,004,604.93, of which amount $508,259.72 was for maintenance during the past five years. Prior to that time the amounts expended for works of improvement and for maintenance were so involved that it would be impracticable to separate them.

With this expenditure the mouth of the river has been widened, the east and west piers rebuilt and capped with concrete, with the exception of a small amount of jetty extension and dredging near the mouth of the Cuyahoga River and south of the Lake Shore Railway bridge, which has not been carried out because the United States has been unable to obtain title to the land which would have to be dredged away. The superstructure of the west breakwater has been removed and replaced by concrete masonry, and the lake face of the cribs protected with riprap. The old east breakwater has been repaired and extended as provided for in the project of 1896, with the exception of about 270 feet, which, being a portion of the shore arm, was not built on account of the modifications in the river and harbor act of June 13, 1902, which rendered its construction unnecessary.

The work at the new entrance and for the extension of the breakwater eastward is being carried on under continuous contracts. The two pierheads to mark the new entrance have been completed, and also about 86 per cent of the protection and two projecting breakwaters. On the breakwater extension work, the western division is about 97 per cent completed and the eastern division about 62 per cent.

From 1899 to 1904, 766,928 cubic yards of material was excavated in the harbor at a cost of $115,000, but, as shown by the annual report of the district engineer for 1904, the deposit which took place over this area during this period has equaled or exceeded the amount of material removed, and the work done, therefore, must be regarded simply as maintenance work and not in advancement of the project.

A contract for removing about 1,250,000 cubic yards of material in the harbor was completed July 20, 1907, a total of 1,270,585 cubic yards having been removed. Work under contract is now in progress for removing about 800,000 cubic yards in the harbor, and there has been removed 552,949 cubic yards of material.

As a result of these expenditures a navigable channel 20 feet in depth has been preserved at the mouth of the river and a large outer harbor constructed available for docks and anchorage. The project as a whole is regarded as about 75 per cent completed.

Cuyahoga River has a navigable depth of 20 feet to Jefferson street, 4 miles above its mouth and 16 feet for 1½ miles farther, and is maintained by local authorities.

The appropriation recommended will be applied toward prosecution of the project for extension of benefits.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce of Cleveland Harbor for the calendar year 1907 amounted to 12,872,448 tons, an increase of 624,822 tons over that reported for the calendar year 1906.

The usual variation in the level of the water surface during the season of navigation is from 1 foot above to 2 feet below mean lake level. Fluctuations due to wind are about 2 feet.

UNDER CONTRACTS, ETC., AUTHORIZED BY ACT OF JUNE 3, 1896.

July 1, 1907, balance unexpended		$49,293.44
Receipts from sales		14.27
Collections on account of damages to pier		50.00
		49,357.71
June 30, 1908, amount expended during fiscal year for maintenance of improvement		3,872.87
July 1, 1908, balance unexpended		45,484.84

MAINTENANCE (DREDGING) AND CONTINUING IMPROVEMENT.

July 1, 1907, balance unexpended		$206,672.59
June 30, 1908, amount expended during fiscal year for maintenance of improvement		101,881.42
July 1, 1908, balance unexpended		104,791.17
July 1, 1908, outstanding liabilities		4,014.59
July 1, 1908, balance available		100,776.58
July 1, 1908, amount covered by uncompleted contracts		41,695.48
Amount (estimated) required for completion of existing project		203,000.00

WHARF ROOM.

July 1, 1907, balance unexpended		$98,000.00
July 1, 1908, balance unexpended		98,000.00

NEW ENTRANCE, BREAKWATER EXTENSION, ETC.

July 1, 1907, balance unexpended		$696,325.53
Amount appropriated by sundry civil act approved May 27, 1908		475,000.00
		1,171,325.53
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$499,266.16	
For Isthmian Canal Commission	[a]18.38	
		499,284.54
July 1, 1908, balance unexpended		672,040.99
July 1, 1908, outstanding liabilities		94,128.56
July 1, 1908, balance available		577,912.43

[a] To be refunded.

July 1, 1908, amount covered by uncompleted contracts	$420,681.24
Amount (estimated) required for completion of existing project	1,818,956.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a] 775,000.00

CONSOLIDATED.

July 1, 1907, balance unexpended		$1,050,291.56
Amount appropriated by sundry civil act approved May 27, 1908		475,000.00
Received from other sources		64.27
		1,525,355.83
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$499,266.16	
For maintenance of improvement	105,754.29	
For Isthmian Canal Commission	[b] 18.38	
		605,038.83
July 1, 1908, balance unexpended		920,317.00
July 1, 1908, outstanding liabilities		98,143.15
July 1, 1908, balance available		822,173.85
July 1, 1908, amount covered by uncompleted contracts		462,376.72
Amount (estimated) required for completion of existing project		2,021,956.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.		[a] 775,000.00

(See Appendix P P 7.)

8. Fairport Harbor, Ohio.—This harbor is situated at the mouth of Grand River, where it enters Lake Erie, about 29½ miles eastward from the harbor of Cleveland. Before the improvement was undertaken the depth across the bar at the mouth of the river was variable and uncertain and quite insufficient for the needs of commerce.

The first improvement was undertaken in 1825, and the original project provided for the construction of parallel jetties of cribwork filled with stone, placed about 200 feet apart and extending outward across the bar and into the lake. The jetties were extended from time to time until the west jetty attained a length of 2,370 feet and the east jetty 1,765 feet from the original shore line. These jetties have been repeatedly repaired and rebuilt as necessities required, and the channel has been deepened and redredged many times.

By the river and harbor act of June 3, 1896, the existing project for this improvement was adopted. This project is described in the Report of the Chief of Engineers for 1896, pages 2956 to 2958, inclusive, and provides for the construction of two breakwaters converging toward the lake, the outer ends being in deep water, and sufficient space being left between them to afford an easy entrance to the jettied channel. The breakwaters were to terminate in pierheads 50 feet square, the west breakwater to have a length of 2,050 feet and the east breakwater 1,350 feet. The estimated cost of the work, including

[a] Balance of contract authorization of March 2, 1907.
[b] To be refunded.

dredging between the breakwaters to a depth of 20 feet, was $510,000, which was revised to $585,000 in 1900. (See Annual Report of the Chief of Engineers for 1900, pp. 4071–4072.)

A further modification of the project occurs in the river and harbor act of March 3, 1905, which provides that the westerly arm of the breakwater may be extended to a point at or near the shore, the expense thereof to be paid from the appropriations therein and theretofore made. The estimated cost of this extension was $120,000.

The total expenditures to June 30, 1899, on the original project, were $378,808.86.

The river and harbor acts of June 13, 1902, and March 3, 1905, provided not only for continuing existing project but for maintenance of the old work. From the various appropriations since 1899 there have been expended $196,167.25 in repairs to old piers and dredging. With these funds 580 linear feet of the shoreward end of the east jetty was completely rebuilt of timber cribs with a concrete top, and 570 linear feet of the west jetty was extensively repaired with tongued and grooved piling below the water and with concrete and stone above, and the outer portion of both jetties was protected below water by a sheathing of hard-wood plank, and the wooden superstructure was completely repaired.

This harbor suffers greatly from the extensive movement of sand which constantly re-forms the bar at the outer end of the jetties, and extensive dredging has also been required.

With the funds available for continuing the improvement, 828 linear feet of the shoreward end of the west breakwater, as provided for in the report of 1896, has been built, and during the year the work of connecting this breakwater with the shore by a rubble mound structure has been completed. A contract is being executed for extending the west breakwater 1,000 feet by means of a rubble mound structure and for the construction of a pierhead at its outer end.

There has been expended on the existing project to June 30, 1908, $416,518.44, of which amount $122,508.03 was for maintenance during the past five years. Prior to that time the amount expended for works of improvement and for maintenance was so involved that it would be impracticable to separate them.

The appropriation recommended will be applied toward prosecution of the project for extension of benefits and to maintenance in keeping the improvement available.

The water-surface variations are similar to those at Cleveland.

The result of these expenditures has been to obtain a channel 20 feet deep across the bar at the mouth of the river and to protect the entrance from westerly storms. The project is regarded as about 45 per cent completed.

A channel of 20 feet depth extends up the Grand River to Richmond, a distance of 1 mile from its mouth, and is maintained by local authorities.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce of Fairport Harbor for the calendar year 1907 amounted to 3,323,495 tons, an increase of 748,477 tons over that reported for the calendar year 1906.

July 1, 1907, balance unexpended		$186,185.57
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$27,868.07	
For maintenance of improvement	2,702.87	
		30,570.94
July 1, 1908, balance unexpended		155,614.63
July 1, 1908, outstanding liabilities		5,845.54
July 1, 1908, balance available		149,769.09
July 1, 1908, amount covered by uncompleted contracts		140,758.15
Amount (estimated) required for completion of existing project		245,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		250,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P P 8.)

9. Ashtabula Harbor, Ohio.—This harbor is situated at the mouth of the Ashtabula River, where it enters Lake Erie, at a point about 56¼ miles eastward from the harbor of Cleveland. In its natural condition the mouth of the river was obstructed by a bar upon which the depth of water varied according to the prevailing conditions of storms on the lake and freshets in the river. The greatest possible depth on the bar was 9 feet, this being the distance to the underlying rock near the shore line. The minimum depth probably did not exceed 2 feet.

The original project for the improvement of this harbor was adopted in 1826 and provided for the construction of two parallel jetties extending outward into the lake. These jetties have been built and repaired from time to time and extended farther into the lake, and the channel has been deepened by dredging to meet the increasing demands of commerce, the project being modified accordingly.

The total amount expended on the original project was $564,382.62.

The existing project was adopted under the authority of the river and harbor act of 1896 and is described in the Report of the Chief of Engineers for 1895, pages 3122 to 3216, inclusive, and provides for the construction of two breakwaters, each 1,500 feet long, and two pierhead cribs, at an estimated cost of $465,000.

The river and harbor act of March 3, 1899, authorized a continuous contract to be made for the construction of these breakwaters, at a cost not to exceed $430,000.

The river and harbor act of March 3, 1905, authorized the expenditure of the unexpended balance on hand to the credit of the improvement for the extension of the west breakwater to a point at or near the shore, and the funds have been applied toward the prolongation of the west breakwater 1,500 feet.

A contract is now in force for constructing the east and west breakwaters. Work under this contract has been progressing very slowly. After completing about 65 per cent of the work on the east and west

breakwaters the contractors failed and the work has been assumed by their sureties, who have completed 17.7 per cent additional.

The contract for extending the west breakwater shoreward was completed June 6, 1908.

The amount expended on the existing project to June 30, 1908, is $683,026.50, of which amount $18,122.66 was for maintenance during the past five years. Prior to that time the amounts expended for works of improvement and for maintenance were so involved that it would be impracticable to separate them.

The project is now 93 per cent completed.

In 1904 the Secretary of War, under authority of law, gave permission to the Pittsburgh, Youngstown and Ashtabula Railroad Company to completely remove the west jetty and to replace the same by a bulkhead 60 feet farther to the west, thus increasing the width of the channel. Under the authority granted by this permit the railroad company has completed 1,120 feet of new dock, composed of stone-filled timber-crib substructure and concrete superstructure, and has made an extensive fill on the lake front and to the westward of the new dock, reclaiming about 16 acres; and the Government pier has been removed to a depth of 18 feet. The northerly end of the fill has been protected by a riprap wall; a dock to westward of the channel, 1,000 feet in length, has been completed; a jetty, 1,250 feet long, protecting this dock, has also been built.

In May, 1906, authority was also granted to the Lake Shore and Michigan Southern Railway Company to make certain improvements on the easterly side of the river. The railway company has taken possession of the east pier and extended it northward 720 feet; thence it is extended about 900 feet easterly; thence southward. meeting the property of the railway company. The inclosure, about 15 acres, has been filled to the level of the docks, about 3,350 feet of crib dock has been completed, and about 7 acres of a second fill to eastward has been built up. The Government east breakwater affords but partial protection to these new docks. The railroad company has been authorized to extend the east breakwater to protect its docks. Work on this improvement was begun in June, 1906, and 1,100 feet of the breakwater is completed. The east basin and slip have been dredged to a depth of 23½ feet.

As a result of these expenditures the depth across the bar at the mouth of the river has been increased to 20 feet and an outer harbor has been provided. A 20-foot channel extends up the river 1½ miles above its mouth and is maintained by the local authorities.

The water-surface variations are similar to those at Cleveland.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce of Ashtabula Harbor for the calendar year 1907 amounted to 11,834,580 tons, an increase of 1,520,451 tons over that reported for the calendar year 1906.

July 1, 1907, balance unexpended		$262,876.45
Received from sales		23.30
		262,899.75
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$116,606.78	
For maintenance of improvement	1,075.73	
		117,682.51
July 1, 1908, balance unexpended		145,217.24
July 1, 1908, outstanding liabilities		14,235.62
July 1, 1908, balance available		130,981.62
July 1, 1908, amount covered by uncompleted contracts		46,535.66

(See Appendix P P 9.)

10. Conneaut Harbor, Ohio.—Conneaut Harbor is at the mouth of Conneaut Creek, in the northeastern part of the State of Ohio, and 69¼ miles east of Cleveland. In its natural condition the creek was obstructed by a bar at its mouth, over which the average depth of water did not exceed 2 feet.

The first improvement was undertaken in 1829 and consisted in the construction of parallel jetties of timber cribs filled with stone. Only a moderate degree of improvement was sought, and the greatest depth ever obtained under this project through the action of these jetties did not exceed 12 feet.

No appropriations at all were made for this harbor from 1880 to 1892. At the end of this period the jetties were in a decayed and ruinous condition, and the channel had filled up with sand and silt, and had practically reverted to its original condition. The harbor could only be used by small sailing craft, such as were then engaged in fishing.

In 1892 a project was prepared which provided for the construction of parallel jetties 200 feet apart and extending outward to a depth of 17 feet in the lake, and appropriations under this project were made to 1896.

Expenditures on the early projects were $112,448.47.

The existing project was authorized by the river and harbor act of June 3, 1896, and is described in the Annual Report of the Chief of Engineers for 1896, pages 2970–2972, inclusive. This project provides for the completion of the jetties to a depth of 17 feet in the lake, and the construction of two detached breakwaters converging toward the lake and designed to shelter the entrance to the jettied channel, and for securing a navigable depth of 20 feet in the channel and sheltered area. The estimated cost of the work was $610,000, exclusive of maintenance.

The total amount expended on existing project to June 30, 1908, is $699,707.28, of which amount $25,760.22 was for maintenance during the past five years. Prior to that time the amounts expended for works of improvement and for maintenance were so involved that it would be impracticable to separate them.

With these funds the project has been completed. Minor repairs were made to the concrete superstructure of the east breakwater July to November, 1907. This work was done by hired labor.

Some shoaling occurred in the harbor during the winter months, and the U. S. dredge *Burton*, between May 22 and June 6, restored the usual width and depth to the channel, removing about 16,242 cubic yards of material.

As a result of these expenditures a depth of 20 feet has been obtained across the bar at the mouth of the creek and an outer harbor has been constructed. A 20-foot channel extends up the river one-half mile above its mouth, and is maintained by local authorities.

The water-surface variations are similar to those at Cleveland.

There has been a marked reduction in freight rates since the project was inaugurated, but it is impracticable to determine how much of this reduction is due to this particular improvement.

The commerce of Conneaut Harbor for the calendar year 1907 amounted to 8,351,407 tons, an increase of 1,288,338 tons over that reported for the calendar year 1906.

July 1, 1907, balance unexpended		$66,398.74
Collection on account of damage to pier, etc		3,002.00
		69,400.74
June 30, 1908, amount expended during fiscal year:		
For maintenance of improvement	$8,962.13	
For Isthmian Canal Commission	[a] 44.14	
		9,006.27
July 1, 1908, balance unexpended		60,394.47
July 1, 1908, outstanding liabilities		19,968.04
July 1, 1908, balance available		40,426.43

(See Appendix P P 10.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—(*a*) *Tug McCormick.*—This vessel, which was carried out into the lake by the ice in January, 1907, was later raised and taken into the Grand River at Fairport, Ohio, by the owners and allowed to sink on the east bank of the channel opposite the warehouse of the Baltimore and Ohio Railway Company. The wreck was removed under contract at a total cost of $293.73.

(*b*) *Dump scow.*—This scow sunk in 1904 on the east bank of the channel in the Black River, Lorain, Ohio, about 500 feet above the Nickel Plate Railroad bridge. Bids were invited, but were rejected as being too high, and the U. S. dredge *Maumee* removed the wreck at a cost of $728.85.

(See Appendix P P 11.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of harbor at Rocky River, Ohio.—Report dated June 14, 1907, is printed in House Document No. 559,

[a] To be refunded.

Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. Preliminary examination and survey of Lorain Harbor, Ohio, including that portion of Black River from the inner end of the Government piers to the East Erie Avenue Bridge.—Reports dated June 17 and August 23, 1907, are printed in House Document No. 560, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $23,000 is presented.

3. Preliminary examination and survey of Maumee River, Ohio, from deep water in Lake Erie to the Fassett Street Bridge, Toledo, with a view to obtaining greater depth and increased width of approximately 100 feet.—Reports dated August 10, 1907, and February 18, 1908, respectively, are printed in House Document No. 868, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $400,000 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE BUFFALO, NEW YORK, DISTRICT.

This district was in the charge of Col. H. M. Adams, Corps of Engineers, to January 18, 1908, and of Lieut. Col. W. L. Fisk, Corps of Engineers, since that date. Division engineer, Col. D. W. Lockwood, Corps of Engineers, from January 18 to February 15, 1908, and Lieutenant-Colonel Fisk since February 15, 1908.

1. Harbor at Erie, Pa.—In its original condition the harbor of Erie was nearly landlocked, the only entrance being at the east end through a channel which was narrow and tortuous, variable in position, with a depth of about 6 feet.

The original project approved March 26, 1824, provided for closing the eastern end of the harbor by means of a breakwater, in which there should be an opening 200 feet wide, and for extending to deep water in the lake two parallel piers, one on each side of the opening. The project also included the necessary work of dredging to keep the channel open, making the necessary repairs to existing structures, and maintaining the Presque Isle Peninsula.

The project was modified by the river and harbor act of March 3, 1899, to require the harbor basin and entrance channel to be dredged to a depth of 20 feet at mean lake level, the north and south piers to be provided with concrete superstructure and extended 500 and 1,000 feet, respectively, and, conditionally, as stated in House Document No. 70, Fifty-fifth Congress, first session, four protection jetties to be built along the outer shore of Presque Isle Peninsula.

The estimated cost of completing the modified project was $377,000.

At the beginning of the past fiscal year, under the modified project, 1,210 feet of wooden superstructure on north pier had been replaced with concrete; the north pier had been extended 510 feet and the south pier 500 feet; two protection jetties had been built; the channel and basin dredged 20 feet deep, and the wooden superstructure on all of the south pier (1,217 feet) had been replaced with concrete.

During the fiscal year 750 feet of old timber superstructure on north pier was replaced with concrete, 1,200 feet of the south breakwater was repaired with stone superstructure, cribs were sunk for a further

extension of 500 feet on south pier, and making blocks for the superstructure was in progress at the close of the fiscal year.

Work proposed for the ensuing fiscal year includes completing the extension of south pier 500 feet; beginning to replace with concrete about 752 feet of old timber superstructure on north pier; doing dredging necessary to maintain project depth in entrance channel; to maintain existing structures, and to protect Presque Isle Peninsula when necessary, all for the purpose of making the improvement available and for extension of benefits.

The total amount expended on the harbor to June 30, 1908, was $1,328,946.31. It is impracticable to separate the cost of construction and maintenance. The project is about 95 per cent completed.

The maximum draft that could be carried June 30, 1908, at mean lake level over the shoalest part of the locality under improvement was 19 feet, and the usual variation of level of water surface is about 2 feet.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following table gives the total arrivals and departures, including tonnage, for the past ten years:

Year.	Number.	Tonnage.	Year.	Number.	Tonnage.
1898	2,939	3,939,019	1903	2,423	3,503,628
1899	3,200	3,961,794	1904	1,996	2,890,321
1900	2,709	3,403,312	1905	2,632	4,134,459
1901	3,405	3,204,325	1906	2,579	4,477,764
1902	2,809	3,873,734	1907	2,927	5,504,896

For more extended information and photographs, see Annual Report of the Chief of Engineers for 1900, page 4100 et seq., and for 1903, page 2115 et seq.; and for list of surveys, see page 3239, Report of the Chief of Engineers for 1897. Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 770 of this report.

A chart of Erie Harbor is issued in the series of charts of the Survey of the Northern and Northwestern Lakes, index 332.

July 1, 1907, balance unexpended		$170,728.78
Received from sales		1.50
		170,730.28
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$29,954.50	
For maintenance of improvement	26,841.14	
		56,795.64
July 1, 1908, balance unexpended		113,934.64
July 1, 1908, amount covered by uncompleted contracts		38,864.41

(See Appendix Q Q 1.)

2. *Harbor at Dunkirk, N. Y.*—This is an artificially protected harbor lying in an indentation of the south shore of Lake Erie, between Point Gratiot on the west and Battery Point on the east. The dis-

tance between these points is 9,600 feet, and the maximum breadth of the indentation is 3,600 feet.

The original depth of water was about 10 feet and 15 to 16 feet to underlying rock.

The project, approved November 30, 1870, provided for a detached breakwater 2,860 feet long, one part of which, 2,300 feet long, was to be nearly parallel with the shore; the other part, 560 feet long, to be nearly parallel with the axis of the entrance channel.

This breakwater and the pier already built, 1,410 feet long, were to form the harbor, and the old channel was to be enlarged to 170 feet wide and 13 feet deep.

The project adopted by Congress and provided for by the river and harbor act of June 3, 1896, consisted in completing the breakwater as before planned by the addition of 360 feet to its eastern end and adding the channel arm 560 feet long, and in addition thereto dredging the entrance channel and a harbor basin, containing in all about 65 acres, to a depth at mean lake level suitable for vessels drawing 16 feet. This work was completed in 1898 at a total cost of $389,060.55.

The total amount expended on the harbor to June 30, 1908, was $981,480.96.

It is impracticable to separate the cost of construction and maintenance.

During the past fiscal year the damage to structures by storm of January 20, 1907, was partly repaired.

Work proposed for the ensuing fiscal year consists in placing the structures in as good repair as practicable with the funds on hand and the additional appropriation asked for.

The maximum draft that could be carried June 30, 1908, at mean lake level over the shoalest part of the locality under improvement was 16 feet, and the usual variation of level of water surface is about 2 feet.

Freight rates have not been affected by the project.

The following table gives the total arrivals and departures, including tonnage, for the past ten years:

Year.	Number.	Tonnage.	Year.	Number.	Tonnage.
1898	180	22,005	1903	237	64,803
1899	192	82,783	1904	117	5,128
1900	278	107,316	1905	115	9,502
1901	171	49,148	1906	111	11,310
1902	143	33,435	1907	97	5,712

For more extended information and map, see Annual Report of the Chief of Engineers for 1898, page 2748 et seq., and for reports of surveys, see page 3127, Annual Report of the Chief of Engineers for 1896, and page 4150, Annual Report of the Chief of Engineers for 1900. Reference to report on examination made in compliance with act of March 2, 1907, will be found on page 770 of this report.

A chart of Dunkirk Harbor is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 318.

July 1, 1907, balance unexpended	$18,308.81
Received from sales	130.00
	18,438.81
June 30, 1908, amount expended during fiscal year for maintenance of improvement	12,202.39
July 1, 1908, balance unexpended	6,236.42
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix Q Q 2.)

3. Harbor at Buffalo, N. Y.—Buffalo Creek was the original harbor of the port of Buffalo. In its original condition the entrance channel from the lake was shallow and frequently closed by a gravel bar. The original project for the improvement of this harbor was adopted in 1826, and provided at first for the construction of piers on the north and south sides of Buffalo Creek. Subsequently a masonry sea wall, 5,400 feet long, was built along the lake shore south of the harbor entrance, and a sand-catch pier of piles and stone, 879 feet long, built out from the shore.

Between 1868 and 1893 a detached breakwater, 7,600 feet long, was built of timber cribs about a half mile distant from the lake shore and parallel with it.

A shore arm about 4,000 feet long was projected in 1874 to extend to the south end of this breakwater, leaving an opening of 150 feet. Work on this was in progress when it was wrecked by storm in 1893.

A new project was adopted in 1895 on the recommendation of a Board of Engineer officers and consisted of the abandonment of the shore arm and the extension of the breakwater to Stony Point.

The report of the Board and details of its plans are published in the Annual Report of the Chief of Engineers for 1895, page 3153 et seq. The river and harbor act of June 3, 1896, added to the project of the Board by providing for the construction of a farther length of the sand-catch pier, extending it to the established pierhead line.

The river and harbor acts of June 6, 1900, and June 13, 1902, made special provision for deepening the entrance to Buffalo Harbor and the city ship canal. The entrance channel has been dredged 23 feet deep at mean lake level for a width of 200 to 300 feet for 2,200 feet outward from outer end of north pier, 150 feet wide between the piers to its inner end (junction of Buffalo River and city ship canal), except over an area of rock at that point, where the depth is from 21½ to 23 feet.

The project now in force for the improvement of Buffalo Harbor, adopted June 3, 1896, and modified by the emergency river and harbor act of June 6, 1900, and the river and harbor acts of June 13, 1902, March 3, 1905, and March 2, 1907, is as follows:

(*a*) To build an extension of the breakwater to Stony Point, leaving the necessary openings for the convenience of commerce.

(*b*) To extend the sand-catch pier to the established pierhead line.

(*c*) To build an arm 1,000 feet long to the Stony Point section of breakwater for the purpose of protecting the south harbor entrance.

(*d*) To maintain existing structures by strengthening timber-crib-concrete portions and by making repairs and replacing the wooden superstructure of the breakwater with concrete and stone when necessary, and to maintain the north entrance channel 23 feet deep at mean lake level.

(*e*) To dredge to a depth of 23 feet at mean lake level an area at south end of harbor sufficient to provide access to canals of Lackawanna Steel Company and Buffalo and Susquehanna Iron Company.

(*f*) To remove to a depth of 23 feet a shoal outside the main or north entrance to the harbor.

Of the above, items (*a*) and (*b*) have been completed, (*c*) is now in progress, (*d*) will be required indefinitely, (*e*) is completed, and it is expected to complete (*f*) during the present season.

During the fiscal year work on the south entrance arm has been continued and it is now being built above water level.

Work of placing stone superstructure, sea slope, and riprap on 723 feet of south harbor section of breakwater was completed and repairs were made to timber structures.

Work of repairing damage by storm of January 20, 1907, to 1,910 feet of old breakwater has been continued during the fiscal year, and good progress made.

Work proposed for the ensuing fiscal year, for making improvements available, and for extension of benefits, consists in continuing work on south entrance arm, removing shoal outside of north entrance to harbor, repairing timber portions of breakwater, and general maintenance of channels and structures.

The total amount expended by the United States on the improvement of Buffalo Harbor to June 30, 1908, was $5,268,518.44. It is impracticable to separate the cost of construction and maintenance.

A good harbor has been obtained. The principal features are north and south piers and the entrance channel between them at the mouth of Buffalo Creek, in which most of the business of the port is done, and the outer breakwater system, consisting of four sections of breakwater of an aggregate length of 22,600 feet, inclosing an outer harbor 4½ miles long and over one-half mile wide. This breakwater system comprises 8,894 linear feet of breakwater of timber-crib-concrete type, 7,250 linear feet of stone or rubble-mound type, 723 feet of timber-crib-stone type, 1,910 linear feet of wrecked timber-crib rebuilding to timber-crib-stone type, and 3,823 feet of timber-crib type.

The maximum draft that could be carried June 30, 1908, at mean lake level over the shoalest part of the locality under improvement was 20 feet. The usual variation of level of water surface is from 3 to 4 feet, with maximum variation much greater.

The project is reported to have a material effort in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The commerce of Buffalo is large. During the year 1907 arrivals and departures of vessels by lake and river aggregated in number 8,205, and in tonnage 14,578,233.

The arrivals and departures of canal boats by the Erie Canal were 5,014 in number, with a tonnage of 1,942,455.

The principal receipts by lake and river were wheat, corn, flour, oats, iron ore, lumber, copper, pig iron, glucose, lard, and pork. The total receipts amounted to 10,928,942 tons.

The shipments by lake were principally coal, sugar, salt, and cement, and aggregated 5,558,298 tons.

For comparison the following table is given, showing the arrivals and departures by lake and canal and the tonnage for the past five years:

Year.	Lake.		Canal.	
	Number.	Tons.	Number.	Tons.
1903	8,727	11,586,719	6,974	1,324,216
1904	7,375	10,783,980	5,132	988,725
1905	7,950	12,090,153	4,902	985,861
1906	8,294	13,876,759	5,666	1,769,919
1907	8,205	14,578,233	5,014	1,942,455

Total shipments and receipts: 1906, 17,338,257 tons; 1907, 18,429,695 tons.

For more extended information and maps and photographs, see Annual Reports of the Chief of Engineers since 1897, and for reports of surveys see page 3153, Report of Chief of Engineers for 1895, and reference on page 703, Report of Chief of Engineers for 1906, printed in full in House Document No. 240, Fifty-ninth Congress, first session.

A chart of Buffalo Harbor is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 312.

July 1, 1907, balance unexpended		$698,336.02
Received from sales		5.00
		698,341.02
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$16,441.33	
For maintenance of improvement	123,063.41	
		139,504.74
July 1, 1908, balance unexpended		558,836.28
July 1, 1908, amount covered by uncompleted contracts		368,311.98

(See Appendix Q Q 3.)

4. Lake Erie entrance to Black Rock Harbor and Erie Basin, New York.—The adopted project contemplates the formation, by dredging and rock removal, of a channel 2,300 feet long, 400 feet wide, and 23 feet deep at mean lake level, except where bed rock is found at a depth of 22 feet, from Buffalo main entrance channel to Erie Basin, and a branch channel and basin 1,920 feet long, 500 feet wide, and 23 feet deep at mean lake level, to Black Rock Harbor, at an estimated cost of $814,643. The act of June 13, 1902, authorized the letting of a continuing contract in the sum of $614,643, exclusive of amount appropriated, for completing the work.

The plan of improvement is printed in House Document No. 125, Fifty-sixth Congress, second session, and in the Annual Report of the Chief of Engineers for 1901, page 3345.

The work was begun April 30, 1903, under a continuing contract for the whole work, to be completed under certain conditions of contract on or before December 31, 1906.

The work was not completed on that date, and the time limit was waived for a reasonable period, the contractor to pay the extra expense incurred by reason of the extension of time.

At the close of the fiscal year work was nearly completed and is expected to be fully completed before December, 1908.

The total amount expended on the project to June 30, 1908, was $641,614.91, all for works of improvement.

The maximum draft that could be carried over the shoalest part of the locality under improvement at mean lake level June 30, 1908, was 10 feet, and the usual variation of level of water surface from 3 to 4 feet, with maximum variation much greater.

For commercial statistics, see report on Buffalo Harbor, New York.

The locality is shown on a chart of Buffalo Harbor and Niagara River to the falls, issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 312, and on an index map facing page 2142, Annual Report of the Chief of Engineers for 1903.

Reference to survey is made on page 592, Report of the Chief of Engineers for 1900.

The project, being auxiliary to the improvement at Buffalo, has not, as a separate work, affected freight rates.

All the funds authorized for this work have been appropriated.

July 1, 1907, balance unexpended	$225,666.99
June 30, 1908, amount expended during fiscal year for works of improvement	52,638.90
July 1, 1908, balance unexpended	173,028.09
July 1, 1908, amount covered by uncompleted contracts	172,543.37

(See Appendix Q Q 4.)

5. Buffalo entrance to Erie Basin and Black Rock Harbor, New York.—The first appropriation, $50,000, for this improvement was made March 3, 1899, and an appropriation of $191,701.25 was made June 6, 1900, to complete the work.

The adopted project is to build a breakwater about 2,200 feet long, covering and protecting the entrance to Erie Basin and Black Rock Harbor and the lake front of Buffalo Harbor between the State structures known as the Erie Basin breakwater and the Bird Island pier.

The project has been completed and the breakwater is the northerly section of the outer breakwater system forming the outer harbor of Buffalo.

The amount expended to June 30, 1908, was $238,436.81, of which $236,278.10 was for constructing and $2,158.71 was for maintenance. No money was expended during the past fiscal year.

The maximum draft that could be carried over the shoalest part of the locality under improvement at mean water level June 30, 1908, was 20 feet, and the usual variation of level of water surface is from 3 to 4 feet, with maximum variation much greater.

For commercial statistics, see report on Buffalo Harbor.

For more extended information, see Annual Reports of the Chief of Engineers for 1897, page 3246 et seq., and for 1901, page 3324 et seq., and for report of survey see page 3246, Report of the Chief of Engineers for 1897.

The locality is shown on a chart of Buffalo Harbor and Niagara River to the falls, issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 312, and on an index map facing page 2143, Annual Report of the Chief of Engineers for 1903.

The project, being auxiliary to the improvement at Buffalo, has not, as a separate work, affected freight rates.

This breakwater is the most northerly section of the breakwater system protecting Buffalo Harbor, and it is recommended that the balance of funds pertaining to this work be reappropriated for improving harbor at Buffalo, N. Y., for maintenance, and that the breakwater be considered as belonging to Buffalo Harbor and dropped as a separate work.

July 1, 1907, balance unexpended	$3,264.44
July 1, 1908, balance unexpended	3,264.44

(See Appendix Q Q 5.)

6. Black Rock Harbor and Channel, New York.—Black Rock Harbor is in reality a canal built along the east bank of Niagara River, located partially between the main shore and Squaw Island, and having at its lower end a lock 36 feet wide by 200 feet long, and a depth of 9½ feet on miter sills at mean lake level. This harbor, or canal, is separated from the Erie Canal by a wall of stone and earth.

The object of the improvement is to provide a channel for deep-draft vessels between Buffalo and Tonawanda around the rapids at the head of Niagara River. This is to be accomplished by making a channel 200 feet wide and 23 feet deep at mean lake level, joining at the foot of Maryland street, Buffalo, the 23-foot channel now under contract, the proposed channel to extend westerly and northerly, through Black Rock Harbor and Erie Canal combined, to the present lock, where a ship lock of the requisite capacity is to be built, the channel to extend from the foot of the ship lock through the Niagara River to deep water above Tonawanda, 400 feet wide and 23 feet deep at mean river level. The estimated cost is $4,500,000. The project contemplated a lock 600 feet in length and 60 feet in width between quoins; but in order to accommodate vessels of the largest size now in use and under construction which may desire to use it, the dimensions of the lock have been increased to 650 feet in length and 70 feet in width.

Report of survey is printed on page 3284 et seq. of report for 1904.

Lands and structures needed in the prosecution of the work have been granted to the United States by the State of New York.

Continuing contracts were authorized by the river and harbor act of March 2, 1907, in the sum of $1,000,000, yet to be appropriated, for prosecuting the project, and such contracts have been made as follows:

For the excavation of the southerly 6,400 feet, more or less, of the channel, to be completed December 31, 1908.

For the excavation of the next northerly 3,400 feet, more or less, of the channel, to be completed December 31, 1910.

For the construction of concrete walls for the ship lock, to be completed June 30, 1912.

The total amount expended to June 30, 1908, was $230,658.90. The project is about 8 per cent completed.

The appropriation recommended will be applied toward payments under existing contracts, to construction of lock gates and machinery,

and to further prosecution of the project, including construction of a bridge at Ferry street, Buffalo.

The maximum draft that could be carried June 30, 1908, at mean lake level, over the shoalest part of the locality under improvement, was 8 feet, and the usual variation of water surface is from 3 to 4 feet.

The project, being auxiliary to the improvement at Buffalo, has not, as a separate work, affected freight rates.

The locality is shown on United States Lake Survey Chart No. 312.

For commercial statistics, see report on Buffalo Harbor and on Tonawanda Harbor and Niagara River, New York.

July 1, 1907, balance unexpended	$1,684,819.97
Received from sales and collections	321.25
	1,685,141.22
June 30, 1908, amount expended during fiscal year for works of improvement	215,478.87
July 1, 1908, balance unexpended	1,469,662.35
July 1, 1908, amount covered by uncompleted contracts	2,111,954.57
Amount (estimated) required for completion of existing project	2,800,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	[a] 1,600,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Q Q 6.)

7. *Tonawanda Harbor and Niagara River, New York.*—In its original condition the navigation of Niagara River from Lake Erie to Tonawanda was obstructed by several reefs and shoals which materially limited the draft of vessels traversing it, and the river in some places had a very swift current. The water in the harbor between Tonawanda Island and the mainland was shoal.

The adopted project of April 11, 1888, as modified June 3, 1896, and June 13, 1902, is to remove obstructions, so as to make a channel 400 feet wide and 18 feet deep at mean river level from Lake Erie to the north line of North Tonawanda, including the dredging of Tonawanda Harbor to a depth of 18 feet.

The river and harbor act of March 2, 1907, also appropriated $3,000 for removing wreck of steamer *Embury* from Niagara River, near Grand Island.

The project is completed except at the Buffalo waterworks intake pier, where the width of the channel is about 100 feet, and from the Tonawanda Iron and Steel Company's docks to the north line of North Tonawanda, where the depth is from 12 to 15 feet.

The amount expended to June 30, 1908, was $655,751.67, all for improvement.

No work is proposed for the ensuing fiscal year.

The commerce of Tonawanda is large. During the year 1907 there were entered and cleared 1,475 lake craft, with a tonnage of 985,059 tons. The receipts were principally lumber, iron ore, and limestone,

[a] Of this amount $1,000,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907.

and aggregated 905,469.4 tons. The shipments from Tonawanda are entirely by Erie Canal.

The maximum draft that could be carried June 30, 1908, at mean water level, over the shoalest part of the locality under improvement, was 15 feet, and the usual variation of level of water surface is 2 feet.

A chart of Niagara River to the falls is issued in the series of charts of Northern and Northwestern Lakes, index 312.

It is reported that the project has a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

For reports of surveys see page 2066, Report of Chief of Engineers for 1888, and page 4155, report for 1900.

July 1, 1907, balance unexpended	$32,944.00
Received from collections	282.35
	33,226.35
June 30, 1908, amount expended during fiscal year for maintenance of improvement	2,995.67
July 1, 1908, balance unexpended	30,230.68

(See Appendix Q Q 7.)

EXAMINATIONS AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and survey required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination with plan and estimate of cost of improvement of Niagara River from Tonawanda to Gill Creek, New York.—Reports dated May 17 and June 15, 1907, are printed in House Document No. 75, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $10,000 is presented.

2. Preliminary examination of Dunkirk Harbor, New York.—Report dated May 9, 1907, is printed in House Document No. 81, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

3. Preliminary examination of Erie Harbor, Pennsylvania, with a view to obtaining a depth of 22 feet and protecting Presque Isle Peninsula.—Report dated May 4, 1907, is printed in House Document No. 83, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government further than as contemplated by the existing project.

IMPROVEMENT OF RIVERS AND HARBORS IN THE OSWEGO, NEW YORK, DISTRICT.

This district was in the charge of Col. H. M. Adams, Corps of Engineers, to January 18, 1908, and of Lieut. Col. W. L. Fisk, Corps of Engineers, since that date. Division engineer, Col. D. W. Lockwood, Corps of Engineers, from January 18 to February 15, 1908, and Lieutenant-Colonel Fisk since February 15, 1908.

1. Harbor at Charlotte, N. Y.—This harbor is at the mouth of the Genesee River. In its original condition vessels of more than 8 feet draft could not cross the bar.

The original project of 1829 was to secure a channel 12 feet deep across the bar by constructing parallel piers to confine and direct the action of the spring freshets. The project of 1882 was to obtain a depth of 15 feet by extending the two piers a total of 3,250 feet and by dredging. After the piers had been extended 1,444 feet the project was modified July 18, 1896, to preserve the depth by dredging without further extension of the piers for the present, and March 2, 1897, it was again modified to obtain and maintain not less than 16 feet and not more than 16½ feet at low water (zero of Oswego gauge) in a channel not more than 200 feet wide.

The piers are nearly parallel, about 450 feet apart. The west pier is 3,616 feet and the east pier 3,109 feet in length; projecting beyond the shore line 2,230 and 2,200 feet, respectively. Fifteen hundred linear feet of the west pier and 300 linear feet of the east pier have been reconstructed with concrete superstructure, such reconstruction being in progress on 1,000 feet of the east pier during the fiscal year; and the channel between the piers was maintained by dredging.

The amount expended to June 30, 1908, was $714,938.47. It is impracticable to separate the cost of construction and maintenance.

June 30, 1908, the maximum draft that could be carried in the channel at low water was 16 feet, and the usual variation of level of water surface is 3 feet.

The Genesee River is navigable for lake vessels for a distance of about 2½ miles above its mouth.

It is reported that the project has a material effect in controlling freight rates on bulk commodities such as coal, grain, lumber, and ore.

The following is a statement of the commerce at this port during the past ten years, in tons: 1898, 483,850; 1899, 447,428; 1900, 388,605; 1901, 549,207; 1902, 557,690; 1903, 569,169; 1904, 554,212; 1905, 597,996; 1906, 432,709; 1907, 701,916.

The work proposed for the ensuing fiscal year, to make the improvement available, is to make necessary repairs to piers and to dredge the channel when required, and the appropriation recommended will be applied to this purpose.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2436.

A chart of Charlotte Harbor is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 241.

July 1, 1907, balance unexpended	$84,420.10
Received from sales and collections	45.46
	84,465.56
June 30, 1908, amount expended during fiscal year for maintenance of improvement	47,299.24
July 1, 1908, balance unexpended	37,166.32
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	80,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix R R 1.)

2. Harbor at Pultneyville, N. Y.—This harbor is at the mouth of Salmon Creek, which empties into Lake Ontario in Wayne County, N. Y. In its original condition the depth was only 20 inches.

The original project in 1871 was to protect the approach to the creek by building two piers in the lake, of timber cribs filled with stone, and to dredge a channel from the 10-foot curve in the lake to the mouth of the creek to a depth of 10 feet at low water, at an estimated cost of $59,000.

In 1875 the material to be dredged was found to be so hard that the estimated cost was increased to $71,000.

The project is completed, except that a depth of 8 feet instead of 10 feet was obtained, the effort to secure the latter having been abandoned in 1900 on account of the difficult dredging.

The piers are 220 feet apart in their parallel portions. The west pier is 910 feet long and the east pier 572 feet long. The west pier extends out in the lake 300 feet farther than the east pier.

No work was done at this harbor between 1900 and 1907, there being no funds available.

An appropriation of $6,000 was made by the river and harbor act of March 2, 1907, for work at this harbor, and project for general repairs to piers, filling space between inner end of east pier and shore with stone, and removing about 7,500 cubic yards sand, etc., from channel was approved March 18, 1907.

During the fiscal year repairs were made on the piers, and a channel not less than 8 feet deep and not less than 14 feet wide was made from the lake to the creek, which is believed to be sufficient for boats using this harbor.

The amount expended to June 30, 1908, was $82,587.84, of which $70,607.96 was for construction and $11,979.88 for maintenance.

June 30, 1908, the maximum draft that could be carried in the channel was 7 feet, and the usual variation is 3 feet.

Salmon Creek is navigable but a short distance above the inner end of the piers.

The project has had no effect on freight rates.

The commerce of Pultneyville, which is a village of about 300 inhabitants, is insignificant, there being only 4 arrivals and departures, with a tonnage of 112, during the year 1907.

Work proposed for the ensuing year, to make the improvement available, is to maintain, as far as funds will allow, the channel at 8 feet depth, and make necessary repairs to the piers.

For more extended information and map, see page 2460 et seq., Report of the Chief of Engineers for 1894.

July 1, 1907, balance unexpended	$5,988.16
June 30, 1908, amount expended during fiscal year for maintenance of improvement	3,576.00
July 1, 1908, balance unexpended	2,412.16

(See Appendix R R 2.)

3. Harbor at Great Sodus Bay, New York.—In its original condition the channel connecting this bay with Lake Ontario was wide and impracticable for vessels drawing over 8 feet.

The original project of 1829 was to narrow the entrance by constructing two converging breakwaters and to secure a channel of 12 feet depth by building two parallel piers about 450 feet apart, connecting with the ends of the breakwater, and by dredging. The

present project, of 1882, is to obtain a depth of 15 feet at low water (zero of Oswego gauge) by extending the two piers a total of 1,100 feet and by dredging. After the piers had been extended 519 feet to their present lengths—west pier, 1,580 feet; east pier, 1,294 feet—the project was modified July 18, 1896, to restore and maintain the channel 150 feet wide between the piers, flaring to 250 feet in the lake, to the requisite depth of 15 feet at low water, by dredging, without further extension of the piers for the present.

The piers are 473 feet apart; east breakwater 1,651 feet long, west breakwater 2,200 feet long. During the fiscal year repairs were made to the piers to the extent necessary to prevent serious damage by seas, with a view to beginning the reconstruction of pier superstructures with concrete, with funds appropriated by the river and harbor act of March 2, 1907, during the next fiscal year.

The United States plant needed for this work will be available on the completion of similar work at Charlotte Harbor.

The amount expended to June 30, 1908, was $499,056.46, of which $90,804.66 was for maintenance.

The minimum depth June 30, 1908, was 14 feet at low water in a channel width of 150 feet, and the usual variation of level of water surface is 3 feet.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of commerce at this port for the past ten years, in tons: 1898, 70,709; 1899, 78,885; 1900, 84,379; 1901, 84,379; 1902, 26,726; 1903, 18,875; 1904, 30,797; 1905, 46,251; 1906, 58,905; 1907, 78,057.

For more extended information and map see Annual Report of the Chief of Engineers for 1881, page 2441 et seq.

A chart of Great Sodus Bay is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 234.

July 1, 1907, balance unexpended	$50,032.12
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,602.78
July 1, 1908, balance unexpended	48,429.34

(See Appendix R R 3.)

4. Harbor at Little Sodus Bay, New York.—In its original condition the channel connecting this bay with Lake Ontario was about 150 feet wide and 18 inches deep.

The original project of 1854 was to protect the channel by building two parallel piers 250 feet apart across the bar to the 15-foot curve in the lake and to connect them with the shore by breakwaters. In 1867 this project was modified to provide for dredging to the depth of 12 feet. The present project, of 1882, is to obtain a depth of 15 feet at low water (zero of Oswego gauge) by extending the piers to the 15-foot curve in the lake, and by dredging. The piers had been extended 835 feet to the following lengths—west pier, 1,747 feet; east pier, 1,510 feet—when the project was modified June 29, 1898, to restore and maintain the entrance channel, 150 feet wide, to the requisite depth of 15 feet, by dredging, without further extension of the piers for the present; and this was modified by the river and harbor act of June 13, 1902, to extend the east pier 300 feet.

This extension was built—timber-crib substructure and concrete superstructure—in 1904, making the present length of the east pier 1,810 feet.

The west pier is 1,747 feet long; the east breakwater 1,680 feet long; west breakwater, 469 feet long, but entirely buried in sand and no longer maintained.

On the west pier 150 linear feet of old timber superstrucure, beginning 30 feet from the outer end of the pier and extending thence south, was replaced with concrete during the fiscal year.

Similar replacement of the superstructure of the remaining 1,597 feet of this pier is in progress with funds on hand.

On the east pier, 1,055 linear feet has concrete superstructure, 120 linear feet of old timber superstructure having been replaced with concrete during the fiscal year, and similar replacement of the superstructure of 341 feet of pier is in progress with funds on hand.

This leaves 414 feet of the pier, viz, a section 363 feet long beginning 300 feet from the outer end and a section 51 feet long at the inner end, with old timber superstructure, for the renewal of which funds are yet to be provided; estimated cost $14,000, including contingencies. The east breakwater, rebuilt with timber in 1889–1891, is becoming decayed and needs repairs, estimated to cost $6,000, including contingencies. Maintenance of the channel is estimated to cost $2,500 for one year, $5,000 for two years. The appropriation recommended will be applied to this work.

The amount expended to June 30, 1908, was $408,228.67, of which $106,865.87 was applied to maintenance of improvement.

The minimum depth over the shoalest part of the locality under improvement, June 30, 1908, was 13 feet at low water in a channel width of 100 feet, and the usual variation of level of water surface is 3 feet.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of commerce at this port for ten years, in tons: 1898, 50,339; 1899, 81,969; 1900, 59,511; 1901, 135,118; 1902, 52,543; 1903, 120,692; 1904, 137,258; 1905, 105,298; 1906, 103,991; 1907, 108,804.

Work proposed for the ensuing year, necessary to make the improvement available, consists in maintenance of channels and piers.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2443 et seq.

A chart of Little Sodus Bay is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index 227.

July 1, 1907, balance unexpended	$74,145.19
June 30, 1908, amount expended during fiscal year for maintenance of improvement	13,090.13
July 1, 1908, balance unexpended	61,055.06
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	25,000.00

(See Appendix R R 4.)

5. Harbor at Oswego, N. Y.—This harbor comprises the lower part of Oswego River, a cove at its mouth, protected by a breakwater now known as the inner breakwater, and an outer harbor formed by an outer breakwater. In its original condition the harbor in the Oswego River was navigable by vessels of light draft only, and the cove had no protection against the lake seas.

The original project of 1827 (completed in 1829) was to build across the cove a breakwater of timber cribs filled with stone. Between 1830 and 1838 a superstructure of masonry was built on 500 feet of this breakwater. Between 1866 and 1869 $41,000 was expended in dredging the harbor to the depth of 12 feet at extreme low water. Between 1868 and 1870 a light-house pier was built, extending north 437 feet from the channel end of the breakwater. In 1871 the project for an outer harbor formed by an outer breakwater was adopted, and in 1881 an outer breakwater was completed having a lake face 4,870 feet long, a westerly shore return 916 feet long, and an easterly return 246 feet long. In 1881 a project was adopted to build an east breakwater, 248 feet of which was constructed in 1881 and removed in 1889. In 1885 and 1889 two spurs to the outer breakwater, 100 and 150 feet long, respectively, were built.

In the acts of March 3, 1893, and August 18, 1894, special provisions were made for extending the deep-water area of the harbor in the mouth of the Oswego River by the removal of rock.

The present project was adopted June 3, 1896, based on a special report printed in the Annual Report of the Chief of Engineers for 1895, page 3213 et seq., and as subsequently modified is, first, to build an east breakwater 1,435 feet long, at an estimated cost of $197,000 (acts of March 3, 1895, and June 3, 1896); second, to narrow the breach made in the outer breakwater in 1884 from 175 to about 75 feet, at an estimated cost of $18,500; third, to widen and deepen the inner harbor in the mouth of the Oswego River and to extend the deep-water area farther upstream by rock excavation.

There are 5,907 feet of outer breakwater and 1,993 feet of inner breakwater and light-house pier, forming an outer harbor containing 140 acres and an inner harbor containing 9.35 acres (including the Oswego River). The areas having a controlling depth of 14.5 feet at low water are 40 acres in the outer harbor and 4½ acres in the inner harbor.

Under maintenance there is required: The maintenance of the outer breakwater and inner breakwater and light-house pier, the maintenance of a depth of 15.7 feet at low water in the entrance channel and in the outer harbor, and the maintenance of a depth of 15 feet at low water in the cove behind the inner breakwater and in the harbor in the mouth of Oswego River.

The plane of reference is low water (zero of Oswego gauge).

The outer breakwater is a weak structure, difficult and costly to maintain.

The river and harbor act of March 3, 1905, made an appropriation for continuing repairs with timber under the method printed as plan "B" on page 3368, Report of the Chief of Engineers for 1904. Under this appropriation extensive repairs were made with timber to the outer breakwater during 1905–6, and owing to extensive damage by storms were continued during the past fiscal year to preserve parts damaged from complete destruction.

The river and harbor act of March 2, 1907, made an appropriation of $100,000 and authorized contracts to the extent of $100,000 additional, yet to be appropriated, for reconstruction under plan "A," printed on page 3368 of the Annual Report of the Chief of Engineers for 1904, which contemplates a stone superstructure and sea slope, at an estimated cost of $900,000. This work was begun during the fiscal year, as stated in Appendix R R 5 of this report.

The amount expended for all work to June 30, 1908, was $2,144,786.76. It is impracticable to separate the cost of construction and maintenance.

June 30, 1908, the minimum depth at low water over the shoalest part of the locality under improvement was 14 feet.

The usual variation of level of water surface is 3 feet.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of the commerce of this harbor for the past ten years, in tons: 1898, 615,503; 1899, 716,753; 1900, 575,160; 1901, 565,052; 1902, 334,009; 1903, 733,734; 1904, 712,481; 1905, 724,502; 1906, 615,840; 1907, 728,090.

Work proposed for the ensuing fiscal year, necessary to make the improvement available and extend its benefits, consists in dredging on shoals as may be required in the outer harbor and entrance channel, continuing the reconstruction of the outer breakwater under plan "A" and repairs on timber structures when required. The appropriation recommended will be applied to this work.

Report of survey of the outer breakwater is printed on page 3363 et seq. of the Report of the Chief of Engineers for 1904.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2451 et seq.

A chart of Oswego Harbor is published in the series of charts of the survey of the Northern and Northwestern Lakes, index 225, and an index map facing page 2160 of the Annual Report of the Chief of Engineers for 1903.

July 1, 1907, balance unexpended	$124,011.43
Received from sales	3,211.23
	127,222.66
June 30, 1908, amount expended during fiscal year for maintenance of improvement	45,112.77
July 1, 1908, balance unexpended	82,109.89
Amount (estimated) required for completion of existing project	800,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	[a] 185,500.00

(See Appendix R R 5.)

6. Harbor at Cape Vincent, New York.—This harbor is an open roadstead on the St. Lawrence River, 2½ miles from Lake Ontario.

[a] Of this amount $100,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907.

and is a convenient location for vessels to lie during storms, at night, and in thick weather.

The original project of 1896 was to build a breakwater parallel to and 600 feet from the railroad wharf, 1,600 feet long, at an estimated cost of $320,000. On May 13, 1899, this project was modified to build a breakwater parallel to and 500 feet from the railroad wharf, 1,550 feet long, of which length 150 feet, or so much thereof as required, was to be a shore return at upper end, at an estimated cost of $200,000. Four hundred and ten feet of this breakwater, of which 50 feet was shore return, was built in 1900, 300 feet was finished in June, 1905, and 200 feet was completed in 1906. Further extension of the shore return is not considered necessary. There remains 540 feet of the main breakwater to be built.

The amount expended to June 30, 1908, was $127,009.40 for construction and $141.77 for maintenance.

The maximum draft that could be carried over the locality under improvement at low water June 30, 1908, was 19 feet, and the usual variation of level of water surface is 3 feet.

The commerce of Cape Vincent is not large. This improvement is intended to make a harbor of refuge for all craft plying between Lake Ontario and the St. Lawrence River.

The following is a statement of the commerce of this port, in tons, for the years given: 1900, 10,721; 1901, 4,209; 1902, 4,175; 1903, 15,666; 1904, 20,083; 1905, 21,750; 1906, 112,501; 1907, 21,946.

Work proposed for the ensuing fiscal year is the extension of the breakwater, if funds are appropriated, and the amount asked for will be applied to this work.

For more extended information and map, see Annual Reports of the Chief of Engineers for 1897, page 3286 et seq., and for 1903, page 2162 et seq.

The project has provided facilities that make navigation more safe and thus affects freight rates.

July 1, 1907, balance unexpended	$990.60
June 30, 1908, amount expended during fiscal year for maintenance of improvement	141.77
July 1, 1908, balance unexpended	848.83
Amount (estimated) required for completion of existing project	72,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	72,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(See Appendix R R 6.)

7. *Harbor at Ogdensburg, N. Y.*—In its original condition the low-water depth in this harbor was 9 feet in the upper entrance channel leading to the Oswegatchie River, 10 to 12 feet in the two lower entrance channels, and 6 to 12 feet along the city front.

The original project of 1868 was to dredge the channels to the depth of 12 feet and to build, if necessary, 5,500 linear feet of piers, at an estimated cost of $100,000. The piers were never built. The project of 1882 provided for dredging the upper entrance channel from the St. Lawrence River channel across the shoal to and into

the mouth of the Oswegatchie to 16 feet, and the lower entrance channels and channels along the city front to 15 feet at extreme low water, at an estimated cost of $75,000. The present project (see Annual Report of the Chief of Engineers for 1890, p. 2872) provided for dredging all the channels to a depth of 16.5 feet below the zero of the Ogdensburg gauge (15 feet below the zero of the Oswego gauge), at an estimated cost of $158,950. The project was modified February 27, 1897, to deepen the two lower entrance channels to 16 feet below the zero of the Oswego gauge, and by act of March 3, 1899, further modified to dredge 900 feet of the channel along the front of Ogdensburg above Franklin street to but 14 feet below the same zero, the projected depths of the upper entrance channel to and into the mouth of the Oswegatchie River up to the bridge, and the balance of the channel along the city front to remain 15 feet. The dredging of all of the channels of the project was completed in July, 1903, but they are not stable, and frequent redredging is necessary to maintain the required depths.

Redredging to restore project depths was in progress under contract at the close of the fiscal year and will be completed during the season of 1908. A balance of about $13,000 will remain on hand on completion of the contract.

Work proposed for the ensuing fiscal year necessary to make the improvement available consists in dredging channels wherever necessary to maintain project depths.

The amount expended to June 30, 1908, was $361,641.63, of which $89,922.42 was applied to maintenance of improvement.

The maximum draft that could be carried over the improvement at low water (zero of new Ogdensburg gauge corresponding to zero of Oswego gauge), June 30, 1908, was as follows: In the lower entrance channels, 16 feet; in the upper entrance channel, 15 feet; in the channel along the city front above Franklin street, 13 feet; below Franklin street, 15 feet. The usual variation of level of water surface is 3 feet.

The project is reported to have a material effect in controlling freight rates on bulk commodities, such as coal, grain, lumber, and ore.

The following is a statement of commerce at this port for the past ten years, in tons: 1898, 645,201: 1899, 670,363; 1900, 646,248: 1901, 646,248; 1902, 837,025; 1903, 1,185,785; 1904, 898,257; 1905, 1,034,085; 1906, 1,056,100; 1907, 1,238,498.

For more extended information and map see Annual Report of the Chief of Engineers for 1881, page 2451 et seq. Reference to reports on examination and survey made in compliance with act of March 2, 1907, will be found on page 779 of this report.

An index map is printed in the Annual Report of the Chief of Engineers for 1903, facing page 2166.

A chart of Ogdensburg Harbor is published in the series of charts of the survey of the Northern and Northwestern Lakes, index 131.

July 1, 1907, balance unexpended	$75,008.77
June 30, 1908, amount expended during fiscal year for maintenance of improvement	19,356.55
July 1, 1908, balance unexpended	55,652.22
July 1, 1908, amount covered by uncompleted contracts	39,273.23

(*See* Appendix R R 7.)

EXAMINATION AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports dated April 22 and August 2, 1907, on preliminary examination with plan and estimate of cost of improvement of *Ogdensburg Harbor, New York, with a view to obtaining a depth of 19 feet*, required by the river and harbor act of March 2, 1907, were duly submitted by the district officer and were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law. They were transmitted to Congress and are printed in House Document No. 920, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $187,970 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE LOS ANGELES, CALIFORNIA, DISTRICT.

This district was in the charge of Capt. Amos A. Fries, Corps of Engineers. Division engineer, Lieut. Col. John Biddle, Corps of Engineers.

1. San Diego Harbor, California.—San Diego Harbor is just north of the national boundary of Mexico and 482 nautical miles south of San Francisco.

The river and harbor act approved March 3, 1875, appropriated $80,000 for the construction of a dike across the mouth of San Diego River, causing it to empty into False Bay, and thus preventing San Diego Harbor from being injured by the deposit of material brought down during flood stages. This work was completed in 1876 at a cost of $79,798.72, which, with the cost of repairs made up to the time of adoption of the present project, brought the total expenditures to $81,918.45. Further repairs to the dike have been made by the city of San Diego.

The project for the improvement of the harbor, adopted by the river and harbor act approved September 19, 1890, provided for the construction of a jetty on Zuninga shoal, at the entrance to the harbor; the maintenance of a channel 24 feet deep at mean low tide and 500 feet wide through the "middle ground," and for repairs to restraining dike. The jetty was to rise to the height of extreme high water and to be about 7,500 feet long, with a view to producing a depth of 26 feet at mean lower low water on the outer bar.

At the time of the adoption of this project the governing depth on the bar was 21 feet. Just inside the entrance was a middle ground carrying but 17 feet of water. The main channel, lying to the west of the middle ground, was of ample depth, but was difficult of navigation on account of two sharp turns.

The original estimated cost of this improvement was $394,400. This estimate was increased in June, 1900, to $542,850. With this amount the jetty was extended to its full contemplated length of 7,500 feet, a channel 26 feet deep and 271 feet wide (28 feet deep over a width of 171 feet) was dredged across the outer bar, and a channel 26 feet deep and 400 feet wide was dredged across the middle ground. Later the channels through the outer bar and the middle ground both shoaled to 24 feet deep. The amount expended on this harbor up to the completion of this project was $625,214.94.

The work done since the completion of the above project has been the maintenance of the channel through the outer bar. Under con-

tracts, 15,625 cubic yards at 60 cents per yard and 37,750 cubic yards at 51 cents per yard was dredged and dumped at sea. A channel 225 feet wide and 28 feet deep over the east 100 feet and 27 feet deep over the west 150 feet has been dredged. This channel has since shoaled to 27 feet depth, which is the maximum draft that could be carried into the harbor at mean lower low water to June 30, 1908. The average height of all high waters above the plane of reference is 4.8 feet.

The amount expended on this project (maintenance) to June 30, 1908, is $29,832.14. Any additional appropriations for maintenance will be expended in dredging the channels through the outer bar and the middle ground.

The commerce of this harbor was 283,559 tons for the calendar year 1907, an increase of 31 per cent over that of the previous year. It consists principally of lumber, general merchandise, and ore shipped. The value of this commerce is estimated to be $11,923,000.

The coastwise trade is carried in vessels drawing from 12 to 20 feet of water, and is benefited but little by the improvement of the harbor. The American-Hawaiian steamers, of 8,000 to 10,000 tonnage each, enter this port once a month. These vessels draw about 26 feet of water and carry 1,000 to 2,000 tons of freight per month for San Diego. Freight for San Diego carried by the Panama steamers is delivered by coastwise steamers from San Francisco. The American-Hawaiian steamers and the Panama steamers have a rate from the Atlantic ports to San Diego averaging about 30 per cent cheaper than railroad rates. Foreign cements are received in this port in sailing vessels drawing 22 and 23 feet of water.

For references to reports on examinations and surveys, see Annual Report of Chief of Engineers for the year 1904, page 632, and page 785 of this report.

July 1, 1907, balance unexpended	$20,059.13
June 30, 1908, amount expended during fiscal year for maintenance of improvement	19,752.95
July 1, 1908, balance unexpended	306.18
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	30,000.00

(See Appendix S S 1.)

2. Deep-water harbor at San Pedro Bay, California.—The river and harbor act of June 3, 1896, provided for the appointment of a Board to determine upon the location of a deep-water harbor for commerce and of refuge in Santa Monica Bay, California, or at San Pedro, in the same State, the decision of a majority of the Board as to location to be final. The Board was to make plans, specifications, and estimates for said improvement. After the Board should have rendered its decision and submitted its report the Secretary of War was empowered to make contracts for the completion of the selected harbor in accordance with the project of the Board, at a cost not exceeding in the aggregate $2,900,000.

In accordance with the provisions of this act a Board was appointed which submitted its report March 1, 1897, deciding in favor

of San Pedro Bay. The report of the Board is printed in Senate Document No. 18, Fifty-fifth Congress, first session.

The plan of the Board (the present project of improvement) was to construct, to the eastward of Point Fermin, a breakwater about 8,500 feet long, or as much longer as could be constructed within the authorized limit of cost, $2,900,000, and it has been decided that a breakwater 9,250 feet long should be built. In plan the breakwater is to consist of two straight arms connected by a curve 1,800 feet in length, of 1,910 feet radius. The westerly arm is to be 3,000 feet long, pointing S. 72° E. (magnetic); the easterly arm, as extended, 4,450 feet long, pointing N. 54° E. (magnetic). A gap of about 1,850 feet is to be left between the east shore of Point Fermin and the westerly end of the breakwater.

Originally San Pedro Bay was an open roadstead exposed to southeasterly, southerly, and southwesterly winds. The effect of the breakwater will be to afford a place of refuge, easy of access and secure from storms, for vessels of the largest size. It will also shelter the entrance to the inner harbor of San Pedro.

On August 12, 1898, a continuing contract was entered into with Heldmaier & Neu, of Chicago, Ill., for the construction of the breakwater for $1,303,198.54. This contract was annulled on March 19, 1900, on account of unsatisfactory progress. Under this contract 86,610 tons of stone was placed in the foundation course, at a cost, including inspection, of $51,537.43.

On June 7, 1900, a continuing contract for completing the breakwater was entered into with the California Construction Company, of San Francisco, Cal. The estimated cost of work under this contract, using the quantities on which bids were canvassed and the prices bid for stone and concrete, and allowing 10 per cent for engineering expenses and contingencies, is $2,613,100.66, in addition to expenditures under the former contract. This estimate is for a breakwater 8,500 feet long. The extension of the breakwater to 9,250 feet in length is estimated to cost about $272,500 additional.

The amount expended under the project up to the close of the fiscal year ending June 30, 1908, is $2,514,128.15.

Work has begun on the westerly end of the substructure. Up to June 30, 1908, 2,036,756 long tons of stone, at $0.844 per ton, had been deposited in the substructure under the present contract, and the substructure was about completed for a distance of 8,607 feet.

The superstructure was begun in October, 1902. To June 30, 1908, 207,766 long tons of stone had been placed in the superstructure, at $3.10 per ton, and this, while partially completing it over a length of 8,403 feet, is equivalent to 8,070 feet of completed work. The project is about 90 per cent completed.

The protected area is used by vessels which have to lighter a part of their cargo or have to await a favorable tide before they can enter the inner harbor. The effect of continuing work under the existing project will be to enlarge the protected area and to increase the shelter afforded the entrance to the inner harbor.

The available balance together with any additional appropriations will be expended in extending the breakwater under the contract.

There are as yet no commercial wharves in the outer, or breakwater, harbor. The construction of bulkheads, etc., has been begun, and it is expected that facilities for commerce will be greatly developed during

the year. For commercial statistics see report on Wilmington Harbor.

For references to reports on examination and surveys see Annual Report of the Chief of Engineers for the year 1904, page 634, and page 785 of this report.

July 1, 1907, balance unexpended	$505,788.87
June 30, 1908, amount expended during fiscal year for works of improvement	219,916.97
July 1, 1908, balance unexpended	285,871.90
July 1, 1908, outstanding liabilities	27,954.19
July 1, 1908, balance available	257,917.71
July 1, 1908, amount covered by uncompleted contracts	295,283.15
Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	100,000.00

(See Appendix S S 2.)

3. Wilmington Harbor, California.—Wilmington is situated at the head of a small estuary which has its outlet in the Bay of San Pedro, and is 393 nautical miles to the southward of San Francisco.

Previous to the commencement of the improvement, in 1871, there was a depth of less than 2 feet of water at low tide at the entrance.

The original project, approved July 1, 1871, contemplated gaining a depth of 10 feet at mean low tide. This depth was obtained in 1881, at a cost of $555,000, when a further project to increase depth of channel to 15 feet at mean low tide by dredging a reef between the jetties, raising existing works, and extending the jetties to 18 feet of water in San Pedro Bay was submitted. This project was completed in 1893, at a cost of $399,497.68.

The river and harbor act of June 3, 1896, appropriated $50,000 for improving the harbor in accordance with a project submitted in 1894 for a channel depth of 18 feet at mean low tide, at an estimated cost of $392,725. Owing to certain provisos, however, this money was not available without further action by Congress.

The present project was adopted by the river and harbor act of June 13, 1902, and contemplates providing a channel 20 feet deep and 400 feet wide from the outer harbor to the foot of the wharves; and 24 feet deep between harbor lines from the foot of the wharves to and including a turning basin 1,600 feet in diameter just below Mormon Island. It also provides for repairs to the east jetty and for the construction of a dike to divert the waters of the Los Angeles River from Wilmington Lagoon. The same act made available the $50,000 appriated by the act of June 3, 1896.

Changed conditions have rendered the building of the dike inadvisable.

The original estimated cost of the work called for by the present project, including the procurement of a dredge, is $550,000. This estimate has been increased to $663,000. The full amount of the estimated cost has been appropriated.

The amount expended under the existing project to June 30, 1908, is $546,567.65, and the project is about 73 per cent completed.

Repairs have been made to the east jetty at a cost of $3,700.

A 20-inch suction dredge, with the necessary discharge pipe, floating plant, etc., has been built at a total cost of $118,721.78. The work of dredging the harbor began April 1, 1905, since which time 2,617,829 cubic yards of material has been dredged and deposited behind bulkhead lines on Terminal Island, or outside the jetties, at a cost of $215,718.43, or about $0.0825 per cubic yard. At the entrance to the harbor 355,785 cubic yards has been dredged under contract at a cost of $168,579.90 (contract payments only), and between the entrance and the upper end of the wharves 249,340 cubic yards has been dredged under contract at a cost of $39,894.40.

The entrance channel has been dredged to a width of 400 feet and a depth of 21 feet. A channel 400 feet wide, with a least depth of 20 feet, has been dredged from the entrance to the lower end of the wharves, and dredging to a depth of 25 feet has been done between the wharves as far north as the turning basin just above Smiths Island, a distance of about 5,000 feet. This depth of 25 feet, with a width of 400 feet, has also been carried along the easterly side of the turning basin a farther distance of about 1,000 feet.

The available balance will be expended in dredging with Government dredge and for contingencies.

In compliance with river and harbor act of March 2, 1907, reports of examinations and surveys of this harbor with a view to obtaining an increased depth will be transmitted to Congress at its next session.

For the calendar year 1907 the commerce of this port amounted to 1,273,600 tons, an increase of 26 per cent over the preceding year. It consists principally of lumber, crude oil, and general merchandise received, and of general merchandise and crude oil shipped. Its value is estimated at $32,348,000.

It is difficult to estimate accurately the effect of this improvement on freight rates. The principal traffic of the harbor is in lumber received from northern California, Oregon, and Washington, and shipped inland by rail, and amounts for the calendar year 1907 to over 1,000,000 tons. The water rate on lumber from Puget Sound points to Los Angeles is about $5 per ton; the railroad rate, $12.50 per ton. Without the improvement of Wilmington Harbor, lumber would have to be unloaded at exposed piers or brought to San Pedro in vessels of light draft or lightered ashore. The saving in freight, lighterage charges, and insurance is large, but can not be definitely stated.

For reference to reports on examinations and surveys, see Annual Report of the Chief of Engineers for the year 1904, page 635.

July 1, 1907, balance unexpended	$185,967.88
June 30, 1908, amount expended during fiscal year for works of improvement	68,935.96
July 1, 1908, balance unexpended	117,031.92
July 1, 1908, outstanding liabilities	1,640.38
July 1, 1908, balance available	115,391.54
July 1, 1908, amount covered by uncompleted contracts	18,000.00

(See Appendix S S 3.)

4. San Luis Obispo Harbor, California.—San Luis Obispo Harbor is 9 miles to the southward and westward of the town of San Luis Obispo and 216 nautical miles from San Francisco.

It is a bight of the coast about 18 miles long between Point San Luis on the north and Point Sal on the south. Port San Luis (formerly Port Harford) is situated at its upper end, where a commercial wharf has been maintained for many years. In 1907 commercial wharves were also built at Avila and at Oilport, just easterly of Avila. The latter wharf, however, was destroyed shortly after it was built.

Whaler reef, extending nearly half a mile to the southward and eastward of Point San Luis, forms more or less of a natural breakwater, but during the winter season the landing was exposed to the heavy swell caused by southerly gales.

The original project was adopted by the river and harbor act of August 11, 1888, and provided for the construction on Whaler reef of a breakwater of rubblestone rising to mean lower low water and extending from Point San Luis to Whaler Island and thence to a point where the outer reef rises above high water. Exclusive of Whaler Island, which is 245 feet long, the breakwater was to have a length of about 1,736 feet, and its estimated cost was $284,898.

This project was modified January 17, 1893, to provide for raising the structure to the height of 6 feet above mean high water, with a top width of 20 feet and such side slopes as might be formed under the action of the sea. The estimated cost was increased to $568,660. This is the existing project.

The amount expended on this work up to June 30, 1908, is $305,834.85, and the project is 53 per cent completed.

There has been placed in the breakwater 137,310 short tons of stone.

The breakwater has been built to full section from Point San Luis to Whaler Island and for 765 feet beyond Whaler Island, and has been partly built up for 595 feet farther, or a total distance of 1,941 feet, including the island. The partially protected area has an available depth of 20 to 33 feet at mean lower low water and there is 30 feet depth at the Port San Luis wharf. The mean rise of tide is 4.6 feet. The result has been to give increased security to vessels in the anchorage and at the landing.

The river and harbor act of March 2, 1907, appropriated $63,660, and authorized continuing contracts for the completion of the work at a cost not to exceed the additional amount of $200,000, of which $140,000 remains to be appropriated.

A continuing contract for completing the breakwater has been entered into with the San Francisco Bridge Company for the delivery of 151,140 tons of stone at $1.57 per ton, which amount will complete the project. Work was to have been begun May 1, 1908, but on account of the shoaling of the channel at the quarry at Morro Rock, and the heavy seas, no stone has as yet been delivered under the contract.

Further work under the project will afford increased shelter. The unexpended balance and the $140,000 yet to be appropriated should be applied to the extension of the breakwater to its full projected length and height.

The commerce consists principally of lumber and general merchandise received and grain and crude oil shipped. Its volume for 1907

is 1,096,054 tons, an increase of 89 per cent over that of the previous year. This great increase is due to the large shipment of crude oil. The value of this commerce is estimated at $9,888,000.

It is impracticable to give definite figures relative to the influence of the project on freight rates. The following, however, may throw some light on the matter. The Union Oil Company pumps crude oil through a 6-inch pipe from its well in the northern part of Santa Barbara County, a distance of 40 to 45 miles, to the landing at Port San Luis, and thence ships it in tank vessels to the Hawaiian Islands and coast points. The Standard Oil Company also ships oil from this port. The cost of delivery of oil in San Francisco is about 10 cents per barrel, and the oil is sold there for from $0.90 to $1 per barrel. The railway rate to San Francisco is about 60 cents per barrel.

Reference to reports on examinations and surveys will be found in Annual Report of the Chief of Engineers for the year 1904, page 636.

July 1, 1907, balance unexpended	$63,659.17
Amount appropriated by sundry civil act approved May 27, 1908	60,000.00
	123,659.17
June 30, 1908, amount expended during fiscal year for works of improvement	833.07
July 1, 1908, balance unexpended	122,826.10
July 1, 1908, outstanding liabilities	79.55
July 1, 1908, balance available	122,746.55
July 1, 1908, amount covered by uncompleted contracts	237,294.00
Amount (estimated) required for completion of existing project	140,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	100,000.00

(See Appendix S S 4.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT OF MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of Newport Harbor, California.—Report dated May 9, 1907, is printed in House Document No. 82, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. Preliminary examination and survey of San Diego Harbor, California, and entrance thereto.—Reports dated May 7, and October 22, 1907, respectively, are printed in House Document No. 961, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $259,250, is presented.

3. Preliminary examination with plan and estimate of cost of improvement of San Pedro Harbor, California, by extending the break-

water to shore.—Reports dated April 30, and June 20, 1907, are printed in House Document No. 969, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $178,000 to $284,800 is presented.

The local officer was also charged with the duty of making a preliminary examination and survey of *Wilmington Harbor, California*, with a view to obtaining increased depth, provided for in the river and harbor act of March 2, 1907, and reports thereon will be duly submitted.

IMPROVEMENT OF RIVERS AND HARBORS IN THE FIRST SAN FRANCISCO, CALIFORNIA, DISTRICT.

This district was in the charge of Lieut. Col. John Biddle, Corps of Engineers, division engineer, Pacific division.

1. Oakland Harbor, California.—The original condition of San Antonio estuary was as follows: It was a tidal arm of the Bay of San Francisco, with a tidal prism of 156,000,000 cubic feet. This filled and emptied itself with each coming tide. The tidal flow was sufficient to maintain a natural channel depth over the bar, off the mouth, of 2 feet at low tide. Within the estuary proper, where the bends are pronounced, mid-channel depths of 20 to 23 feet at low water and widths of 500 feet were found. Vessels drawing 5 to 8 feet could enter at high tide. The commerce in 1874 aggregated 154,300 tons.

The original project was submitted in 1874 in compliance with an act of Congress. The report, with project and estimate of cost, is printed in the Annual Report of the Chief of Engineers for 1874, page 378. This project called for (*a*) two mid-tide training walls at the entrance, (*b*) a tidal canal for flushing purposes about 1½ miles in length to connect with tide water in San Leandro Bay, (*c*) a dam at the entrance to San Leandro Bay, and (*d*) dredging a tidal basin and then a channel to have a depth of 20 feet from the basin to San Francisco Bay. The estimated cost of the work was in round numbers $1,815,000.

This was approved by Congress, and during the progress of the work slight modifications were made from time to time. These consisted of raising the training walls to full high-tide level; of increasing the width of the tidal canal to 400 feet; of building three steel bridges across the tidal canal; and of diverting the silt-laden storm waters of Sausal Creek from the tidal canal by means of a separate channel into San Leandro Bay.

The present project was adopted before this project was completed. Up to and including 1900, $2,450,600 had been expended on the original project.

In the river and harbor act of 1900 Congress provided for an examination of Oakland Harbor with a view to its improvement west of the tidal canal to meet the needs of present and prospective commerce. Three alternative plans and estimates for channel enlargement were submitted, estimated to cost, respectively, $646,293, $1,687,818, and $968,203. This report, with estimates, is printed in the Annual Report of the Chief of Engineers for 1901, pages 3448–3449.

On June 13, 1902, Congress appropriated $100,000 and authorized continuing contracts for $150,000 additional for the work, but failed

to specify to which of the above projects the funds were to be applied. Contract was made to the extent of the money available and authorized for dredging work which was common to all of the above projects. By act of March 3, 1905, Congress specifically named project No. 3, estimated to cost $968,203, appropriated $100,000, and authorized contracts for $250,000 additional for continuing the improvement with a view to obtaining a channel 300 feet wide and 25 feet deep from San Francisco Bay to Fallon street, Oakland.

Project No. 3 calls for a channel from San Francisco Bay, 500 feet wide and 25 feet deep at low water, to Chestnut street, Oakland; thence 300 feet wide and 25 feet deep at low water to Fallon street; thence 300 feet wide and 17 feet deep to tidal basin; thence 300 feet wide and 12 feet deep around the tidal basin, and extension of south jetty.

In the act of March 2, 1907, Congress provided for the project No. 3, as recommended by the Board of Engineers for Rivers and Harbors in report of January 11, 1907, printed in River and Harbor Committee Document No. 9, Fifty-ninth Congress, second session, but the act extended the provisions of the project as follows:

Extension of south jetty 500 feet, widening to 500 feet the channel 25 feet deep from San Francisco Bay to Fallon street, deepening to 25 feet the channel 300 feet wide from Fallon street to the tidal basin, deepening to 17 feet the channel 300 feet wide around the north side of the tidal basin to the tidal canal, and from the tidal canal along the Alameda shore to Tenth avenue. The two preceding paragraphs cover the final project. The estimate of cost is $1,468,203.

It is proposed to defer the construction of the extension of the south jetty until the necessity for such an extension should be more apparent.

The work is in progress under the continuing-contract system. The balance of the contract authorization of 1907 remaining to be appropriated is $110,000; of that of 1905, $146,000.

On June 30, 1908, at low-tide level, a channel 300 feet wide and 25 feet deep has been made for a length of 25,000 feet easterly from deep water in San Francisco Bay; also a channel 400 feet wide and 20 feet deep from said bay to Chestnut street, 300 feet wide and 17 feet deep to the tidal basin, and 300 feet wide and 8 feet deep on the south side of the tidal basin, and 300 feet wide and 8 feet deep on the north side of the tidal basin. The above depths could be carried at low water on June 30, 1908, except that shoaling had taken place since the dredging at the mouth, reducing the available depth to about 21 feet. Under the terms of the existing contract this will be removed about September 1, 1908. The tidal range is from 4.5 to 5.5 feet. The navigable portion of the channel is about 30,000 feet in length. Shallow-draft low vessels can go a mile farther. The amount spent on existing project is $427,748.63. The project is about one-third completed.

The money thus far spent has been practically all for extensions in channel widths and depths for the benefit of commerce. There has been spent for the maintenance of bridges $3,962.29.

It is difficult to estimate what increase of commerce is likely to result from an increased depth and width of channel in Oakland Harbor. At present about 72 per cent of the total tonnage of Oakland Harbor is overland freight transferred across the bay on ferry-

boats, which, when loaded with cars, draw only about 8 feet of water. If improvement be continued it will permit the deeper draft vessels carrying to the city of Oakland coal, wood, coke, oil, hay, grain, flour, lumber, building material, and sundries, which in 1907 amounted to 4,210,125 tons, valued at $161,337,372, and also should induce a large increase in manufacturing industries on the shores of this harbor.

It is believed that the improvement has had no effect on freight rates.

It is proposed to spend the funds estimated to carry out contracts for dredging already authorized and to continue dredging in accordance with project directed by Congress. This will be for the extension of benefits.

It is proposed to spend the funds available for dredging in accordance with contract, for extension of benefits. The amount asked for as maintenance it is proposed to use for repairs of bridges and for dredging small shoals that may develop, particularly at the mouth of the channel. The original project did not provide for maintenance. It has developed that the bridges have to be maintained and that shoals develop and must be dredged. This is in part due to the fact that while the tidal prism remains the same as in the project of 1874, the size of the channel is largely increased in the present project.

In connection with this improvement a tidal canal connecting San Leandro Bay with Oakland channel was excavated by the United States. This canal was intended for flushing purposes only and no provision was made for operation of bridges over it which are owned by the United States and are provided with draws. A demand appears to have arisen for the opening of the canal to navigation, as explained in the district officer's report, but the bridges form an impediment to such use, and he recommends that they be turned over to the local authorities who have signified their willingness to accept and operate them.

July 1, 1907, balance unexpended		$158,050.38
Amount appropriated by sundry civil act approved May 27, 1908		190,000.00
		348,050.38
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$59,633.72	
For maintenance of improvement	3,962.29	
		63,596.01
July 1, 1908, balance unexpended		284,454.37
July 1, 1908, outstanding liabilities		34,427.60
July 1, 1908, balance available		250,026.77
July 1, 1908, amount covered by uncompleted contracts		358,796.19
Amount (estimated) required for completion of existing project		756,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		[a] 521,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix T T 1.)

[a] Of this amount $146,000 is under continuing-contract authorization of 1905 and $110,000 under that of 1907.

2. San Pablo Bay, California.—Before work was commenced there was a shoal about 27,000 feet long, with a least depth of 19 feet at low water, with a gradual increase of depth toward each end of the shoal, where the depth was 30 feet. These depths extended from 1,000 to 1,500 feet in width, and outside of these widths there is a gradual shoaling to each side of the bay. Ships going to and from Port Costa warehouses, from which most of the grain raised in California is shipped, and ships going to and from Mare Island Navy-Yard, all passed over this shoal. In many cases it was necessary to choose the time of high water to pass over the shoal with ships not fully laden. All the commerce passing into and from the Sacramento and San Joaquin rivers passes over this shoal. No project was adopted or improvement made prior to the present project.

Report on examination, with estimate, is printed in the Annual Report of the Chief of Engineers for 1900, page 4260. The project contemplates a channel 300 feet bottom width, 30 feet depth at low water, and 27,000 feet long; estimated to cost $381,000, and about $16,000 per year thereafter for maintenance. Congress adopted this project on June 13, 1902.

This work was completed February 6, 1906. A survey made in April and May, 1907, showed that the channel had shoaled over four-fifths of its length, this shoaling extending for one-half a mile, so as to give a depth of only 24 feet, and amounting to 1,000,000 cubic yards. An examination made in May of this year shows a further shoaling.

The amount expended on this project to June 30, 1908, is $332,088.94.

On June 8 a joint Army and Navy Board appointed to consider the approach from San Francisco Bay to Mare Island Navy-Yard submitted to the Secretary of War a project for a channel through San Pablo Bay 30 feet deep and 500 feet wide. The estimate was made in connection with the improvement of Mare Island Strait and can not be separated.

The maximum available depth June 30, 1908, at low tide is about 22 feet. The ordinary range of tide is from 3.5 feet to 5.5 feet.

Improvement is needed to permit naval vessels to reach Mare Island Navy-Yard at all stages of the tide. It is not required by the present commerce, and has had no effect on freight rates.

The funds on hand will be used to make examinations and to dredge any small shoal places that may develop.

July 1, 1907, balance unexpended	$21,670.16
June 30, 1908, amount expended during fiscal year for works of improvement	590.69
July 1, 1908, balance unexpended	21,079.47

(See Appendix T T 2.)

3. San Joaquin River, California.—Before improvement the channel below Stockton was crooked and difficult to navigate, with a depth of 6 feet and less at low tide. Above Stockton it was navigable only at high water for a few months of the year and carried but little commerce.

The first examination and survey was made in 1875. (See Report of the Chief of Engineers for 1875, page 729.) In 1877 (see Report of the Chief of Engineers for 1878, page 1302), a plan of improvement

was submitted to dredge shoal parts to 6 feet and to cut off sharp bends. This project was modified from time to time. The present project is generally to secure and maintain by dredging and by cut-offs a channel 9 feet deep and 100 feet wide to Stockton, and one 4 feet deep and 80 feet wide in Mormon Slough up to Miller's warehouse, as well as a temporary improvement of the upper river by snagging, dredging of bars, and partial closing of side channels. No definite estimate has been made for this project. The work done has been practically the use of such funds as were available to improve the worst stretches in the river as they developed year by year. Eight cut-offs have been made below Stockton by the United States and several by the State of California. The dredged depths and cut-offs have maintained themselves fairly well in the main river, but it has been impracticable, on account of the large amount of débris brought down by Mormon Slough, to maintain without continuous dredging navigable depths in Stockton channel, which is about 1½ miles in length and on which the city of Stockton is situated.

The total amount expended on the project up to June 30, 1908, was $552,936.94.

A heavy rainfall during the winter of 1906–7 resulted in heavy freshets, which caused an immense amount of detritus to be brought down Mormon channel and deposited in Stockton channel in such quantities that in December, 1906, navigation into the town of Stockton was stopped, the regular daily boats plying between Stockton and San Francisco having to discharge their cargoes just inside Stockton channel, a little over a mile from the wharves. Emergency contract was made on December 28, 1906, with the San Francisco Bridge Company to dredge a channel in Stockton channel, and work was commenced in January, 1907, and completed September 5, 1907. The total quantity of material removed under this contract was 312,404 cubic yards.

In March, 1908, this channel had again filled to such an extent that redredging was necessary. Emergency contract was made and work was commenced March 25 and completed May 28, 1908. The total amount of material dredged under this contract was 176,207 cubic yards.

Navigation was kept open to Stockton the entire year. This would, however, not have been possible had not the city of Stockton under permit of the War Department constructed a dam near the mouth of the slough, which intercepts temporarily the flow of the slough, discharging it into the San Joaquin River above the mouth of Stockton channel, after passing over a wide tract of land on which most of the material carried is deposited.

This unfavorable condition at Stockton channel will be largely remedied by the construction of an intercepting canal for which funds have been appropriated.

The maximum depth that could be carried to Stockton at mean low tide on June 30, 1908, was about 6 feet. The extreme tidal range is about 3 feet; the freshet range about 12 feet. The distance from Stockton to the mouth of the San Joaquin River is 50 miles. About 2 to 3 feet can be carried at low water up the San Joaquin River about 20 miles. At high water boats go occasionally to Hill's Ferry, 150 river miles above Stockton.

The commerce of the San Joaquin River is reported by Mr. J. M. Eddy, secretary of the Stockton Chamber of Commerce, as reaching 736,472 tons during the year 1907, valued at $25,000,000, exclusive of the freight carried by the steam and gasoline launches plying between Stockton and the many river islands which are under cultivation, and which carry large amounts of supplies and produce, but of which no accurate account can be obtained. Nearly all of this freight is carried on the lower San Joaquin River below Stockton, the commerce of the upper San Joaquin being small. The commerce is reported to be lighter than last year on account of the stoppage of navigation in Stockton channel during several months.

The nature of the commerce has not been changed by these improvements. The improvements have undoubtedly had effect on freight rates, though the amount can not be ascertained.

Funds appropriated will be used in dredging and snagging for the extension of benefits.

On March 7, 1908, in accordance with act of Congress of March 2, 1907, a survey was ordered of this river and its tributary, Stockton channel, from San Francisco Bay to Stockton, Cal., with a view to a 9, 12, and 15 foot navigation. There are now five survey parties engaged on this work, in conjunction with a similar survey of the Sacramento River, and it is expected that it will be completed and a report thereon submitted early this fall.

July 1, 1907, balance unexpended	[a] $33,617.17
June 30, 1908, amount expended during fiscal year for maintenance of improvement	31,884.11
July 1, 1908, balance unexpended	1,733.06
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	30,000.00

(See Appendix T T 3.)

4. Stockton and Mormon channels, California.—The act of June 13, 1902, provided for the diversion of the waters of Mormon channel into the Calaveras River. The project is printed in the Annual Report of the Chief of Engineers for 1899, page 3189. Its estimated cost is $255,016. Congress has now appropriated $224,316 for the work. By act of March 2, 1907, Congress authorized contracts not exceeding $56,079, yet to be appropriated, for completing the project.

The act of 1902 requires that the city of Stockton or the State of California shall first furnish to the United States the right of way for the canal. The title to the right of way has been acquired by the State of California and transferred to the United States.

This work will be carried on under continuing-contract appropriations, and the balance of the authorization is $56,079.

A survey for the diverting canal was made in January of this year, specifications prepared and approved, and bids for constructing the canal are to be opened July 8, 1908.

[a] Erroneously reported last year as $34,210.52.

This canal will, however, not entirely prevent débris from being carried into Stockton channel from Mormon Slough. The south bank of this slough above the canal is low and at high water overflows. Until this south bank is leveed part of the high-water discharge of Mormon Slough will be into Stockton channel.

July 1, 1907, balance unexpended	$224,316.00
June 30, 1908, amount expended during fiscal year for works of improvement	1,955.69
July 1, 1908, balance unexpended	222,360.31
Amount (estimated) required for completion of existing project	56,079.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	56,079.00

(See Appendix T T 4.)

5. *Mokelumne River, California.*—This river, a tributary of the San Joaquin River, is a tidal stream, navigable in the main stream, including its south branch or fork, for about 34 miles. The head of navigation is now at the Galt-New Hope Bridge, 20 miles above the mouth of the river. Six feet depth at low tide can be carried to the mouth of Snodgrass Slough, about 13 miles above the mouth of the river; then a shoal is found, less than half a mile in length, with a depth of 2 feet over it to New Hope Landing, which for many years past has been the upper terminus of a line of steamboats plying from San Francisco. The tidal range is about 3 feet.

Before improvement, navigation was difficult on account of snags and overhanging trees. Project for their removal was made in 1881, estimated to cost $8,250. (See Annual Report of the Chief of Engineers for 1882, p. 2637.) This project was enlarged in 1891 to include the closing of a small slough or canal and removing by dredging a tongue of land opposite New Hope Landing and continuing the work of snagging. (See Annual Report of the Chief of Engineers for 1891, p. 3135.) Since that time work has been done at irregular intervals.

The total amount expended on this improvement to June 30, 1908, was $20,374.24.

During September, 1907, snags obstructing navigation were removed from the river, cut-offs were made, and sand bars aggregating 675 feet in length were removed.

The balance now available will be applied toward removing any snags which may obstruct navigation.

The improvement has resulted in a reduction of freight rates. There have been no records kept of the tonnage on this river. It is estimated by various parties as between 50,000 and 100,000 tons. This is largely carried by scow schooners on irregular trips. The steamboat company operating on the river gives the amount of tonnage carried by its steamers as 14,640 tons, at an estimated value of $1,000,000. The imports are lumber, coal, live stock, and merchandise; the exports, grain, fruit, vegetables, and other produce.

The amount estimated for the fiscal year 1910 will be used to extend benefits, principally by snagging.

July 1, 1907, balance unexpended	$3,697.12
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,071.36
July 1, 1908, balance unexpended	2,625.76
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement in addition to the balance unexpended July 1, 1908	2,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix T T 5.)

6. Petaluma Creek and Napa River, California.—(*a*) *Petaluma Creek.*—This creek has a length of 16 miles and is an estuary of San Pablo Bay. Its head of navigation is the town of Petaluma, a place of about 4,000 inhabitants.

Before improvement it was very crooked, dry in many places at low tide, and could be navigated only at medium or high-tide stages. The extreme tidal range is a little less than 9 feet.

Project was made in 1880 for straightening the creek by making cut-offs and dredging so as to obtain a channel 50 feet wide and 3 feet deep at low water, estimated to cost $25,868. (See Annual Report of the Chief of Engineers for 1880, p. 2243.) In 1892 the project was extended to dredge the channel as deep as funds would permit. Work has been done under the project as funds were appropriated. The project was enlarged by the river and harbor act of March 2, 1907 (see H. Doc. No. 387, 59th Cong., 1st sess.), to provide for dredging a channel 6 feet deep at low tide and 50 feet bottom width from the mouth of the creek to McNears Canal, and 4 feet deep and 50 feet wide thence to the head of navigation at Petaluma. The additional cost of this work is estimated at $15,239, which was appropriated March 2, 1907.

During the year contract was entered into to dredge this creek, and up to June 30, 1908, about 40,000 cubic yards of material has been dredged and properly deposited. When this contract is completed there will be a channel 6 feet deep and 50 feet wide at low tide to McNears Canal and 4 feet deep and 50 feet wide thence to the town of Petaluma.

On June 30, 1908, this work was about one-quarter done. The maximum draft that can be carried June 30, 1908, at mean low water over the shoalest part is 4 feet. The usual tidal range is about 8 feet.

The amounts available and estimated for the fiscal year 1910 will be used for dredging and snagging, and are to extend benefits.

The total amount expended to June 30, 1908, is $71,442.66. Navigation is very important to the community and has probably had effect in keeping down rates, though it can not be definitely stated that there has been any reduction in freight rates due to the project. It has, however, encouraged the establishment of factories in the town of Petaluma.

During the year 1907 the commerce was carried by two stern-wheel steamers, the *Gold*, of 293 tons, and the *Sonoma*, of 260 tons, both of which made regular round trips throughout the year, and by scow schooners, which carried the heavier freight. It is reported that 149,943 tons of freight, valued at $4,957,383, was carried on the creek during the year 1907.

July 1, 1907, balance unexpended	[a] $17,430.48
June 30, 1908, amount expended during fiscal year for works of improvement	3,634.14
July 1, 1908, balance unexpended	13,796.34
July 1, 1908, outstanding liabilities	691.81
July 1, 1908, balance available	13,104.53
July 1, 1908, amount covered by uncompleted contracts	11,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	([b])

(*b*) *Napa River.*—Before improvement this river had a low-water depth of 5 feet for about 12 miles above the Mare Island Navy-Yard and about 1 foot depth on the crest of the bars in the next 4 miles of its length to the head of navigation in front of the town of Napa. The ordinary range of tides is about 5 feet. Spring tides reach a height of 7 feet.

Project for the improvement was made in 1888, which contemplated the dredging of the bars and cutting off projecting points of land so as to obtain a channel 75 feet wide with a least depth of 4 feet at low tide and to remove logs, snags, and other obstructions. The estimated cost was $27,600. Examinations were again ordered by Congress and made in 1896, 1899, and 1902. Report on the latter is printed in the Annual Report of the Chief of Engineers for 1904, page 3427.

Navigation on the river is possible and profitable only at medium and high stages of the tide. The existing project and old project are identical.

Work was begun in accordance with the project in 1889 and has progressed since whenever funds became available. The amount expended on this improvement to June 30, 1908, is $37,054.09.

An emergency contract at 17¾ cents per cubic yard for dredging the shoals in this river was completed on December 3, 1907. This gives a channel 4 feet deep at low tide and 75 feet wide up to the head of navigation, completing the project. Further operations will be maintenance of the improvement.

The maximum draft that can be carried June 30, 1908, at mean low water over the shoalest part is 4 feet.

The amounts available and estimated for the fiscal year 1910 will be used for dredging and snagging, and are to extend benefits.

Freight rates are reasonable, due to the maintenance of navigation.

The commerce of Napa River during the year 1907 was carried on three regular steamers and several scow-schooners which make irregular trips on the river. The freight carried on this river during the year is reported at 349,880 tons, the value not being given.

[a] Erroneously reported last year as $17,427.98.
[b] See consolidated money statement on page 795.

July 1, 1907, balance unexpended	$9,178.75
June 30, 1908, amount expended during fiscal year for works of improvement	4,303.48
July 1, 1908, balance unexpended	4,875.27
July 1, 1908, outstanding liabilities	75.00
July 1, 1908, balance available	4,800.27
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirement of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

CONSOLIDATED.

July 1, 1907, balance unexpended	$26,609.23
June 30, 1908, amount expended during fiscal year for works of improvement	7,937.62
July 1, 1908, balance unexpended	18,671.61
July 1, 1908, outstanding liabilities	766.81
July 1, 1908, balance available	17,904.80
July 1, 1908, amount covered by uncompleted contracts	11,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	25,000.00

(See Appendix T T 6.)

7. *Humboldt Harbor and Bay, California.*—A description and history of the work done at this locality is printed in the Annual Report of the Chief of Engineers for 1900, page 4237.

Before improvement the entrance to the harbor was obstructed by a bar having channel depths of 12 to 15 feet. This channel was not fixed in direction, and sometimes for weeks at a time vessels were bar bound. Inside the harbor, in front of the towns of Eureka, Arcata, and Hookton, the channels were very shoal.

In 1881 project for deepening the channels in front of these towns by dredging was adopted. (See Annual Report of the Chief of Engineers for 1881, p. 2481.) The work was done by contract, was completed in 1884 at a cost of $80,884.69, and resulted in channels 200 feet wide and 12 feet deep in front of Eureka and 100 feet wide and 10 feet deep in front of Arcata and Hookton.

In 1882 project for improving the entrance to the harbor was adopted. It called for a low jetty, estimated to cost $600,000, which was to be about 6,000 feet in length, to extend from the south spit seaward. This was somewhat modified in 1888 and again in 1891, so as to build nearly parallel high jetties, each about 8,000 feet in length, to extend seaward to the crest of the bar. The estimated cost of the work was $2,057,615.

The work on the jetties was commenced in 1889 and was completed in August, 1899, at a cost of $2,040,203.35. It resulted in a good channel, having a least depth of 28 feet at low water. A resurvey, made in August, 1903, showed a channel through the entrance having

[a] See consolidated money statement on this page.

a least low-water depth of 31 feet. Since that time the channel has in places deteriorated. A bar has formed outside the entrance whose longer axis is nearly at right angles to the former jetty channel. The result is that vessels instead of going straight to sea, as formerly, now make a sharp turn to the right, broadside to the sea, immediately on passing the outer end of the north jetty. The depth of water in the channel between the bar and the north jetty is sufficient, but on account of its direction it is dangerous for vessels passing in and out during rough weather.

A resurvey of the bar was made in July and August, 1905, which showed channel depths of 23 feet straight out to sea, 19-foot depths in south channel, and 26-foot depths in north channel.

In March, 1899, project was adopted for dredging a channel 15 feet deep, 200 feet wide, and 8,900 feet long in front of Eureka, estimated to cost $50,000. Work was done by contract, and a channel of the dimensions contemplated was completed in March, 1901, and has since been well maintained.

By act of March 2, 1907, Congress adopted a project for further improvement in accordance with report printed in House Document No. 228, Fifty-ninth Congress, first session, which contemplates enlargement of the channel in front of Eureka to a depth of 18 feet and width of 300 feet for a length of 6,200 feet, at an estimated cost of $83,000.

The amount expended on this work to June 30, 1908, is $2,179,002.20.

On June 30, 1908, the depth of water at the entrance to the harbor is about 22 feet at extreme low water. At the wharves at Eureka it is about 15 feet. The tidal range is about 5.5 feet.

Since the improvement the population of Eureka and vicinity is claimed to have increased from 7,000 to about 35,000 persons. The commerce has increased. Deeper-draft vessels and more of them now run regularly to Humboldt Bay.

During July-September, 1907, an examination and survey of the entrance, jetties, and channel was made. This survey showed considerable deterioration in both channel and jetties since the last survey of 1903. The report with project is printed in House Document No. 950, Sixtieth Congress, first session. Further reference to reports on examination and survey made in compliance with act of March 2, 1907, will be found on page 797 of this report.

A contract has been let to enlarge a channel in front of Eureka to 18 feet and 300 feet wide. Work was begun on June 8. On June 30 about one-fifth was done.

The following table shows the increase in the annual commerce since 1885:

	Passengers.	Freight.		Passengers.	Freight.
		Tons.			*Tons.*
1885	4,195	162,614	1906	35,423	706,549
1895	11,514	236,378	1907	32,617	834,634
1905	32,748	616,753			

The tonnage of 1907, valued at $18,461,453, was carried on 1,853 steam and 179 sailing vessels.

The improvements have undoubtedly lessened freight rates.

July 1, 1907, balance unexpended	$92,317.95
June 30, 1908, amount expended during fiscal year for works of improvement	705.15
July 1, 1908, balance unexpended	91,612.80
July 1, 1908, outstanding liabilities	14,473.57
July 1, 1908, balance available	77,139.23
July 1, 1908, amount covered by uncompleted contracts	77,139.23

(See Appendix T T 7.)

8. Removing sunken vessels or craft obstructing or endangering navigation.—During the month of April, 1908, the wreck of the barge *Lighter No. 1*, belonging to the American-Hawaiian Steamship Company, under charter to the Napa Gravel and Material Company, was removed from Napa River, California, at a cost of $399.33.

(See Appendix T T 8.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and survey required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of Islais River, California.—Report dated April 25, 1907, is printed in House Document No. 77, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

2. Preliminary examination and survey of Humboldt Harbor, California.—Reports dated May 24, 1907, and April 16, 1908, are printed in House Document No. 950, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $1,037,400 is presented.

The local officer was also charged with the duty of making preliminary examinations and surveys provided for in the river and harbor act of March 2, 1907, as follows, and reports thereon will be duly submitted when received:

1. San Francisco Harbor, California, with a view to removal of Mission Bay rocks, Packard rocks, Whiting rock, Fifteen-foot rock, Invincible rocks, Noonday rocks, Anita rock, Centissima and Sears rocks, and rocks near Mail Dock in Bonita channel.

2. San Joaquin River, and Stockton channel, from San Francisco Bay to Stockton, Cal.

3. Suisun channel, California.

IMPROVEMENT OF RIVERS IN THE SECOND SAN FRANCISCO, CALIFORNIA, DISTRICT.

This district was in the immediate charge of Capt. Thos. H. Jackson, Corps of Engineers, under a Board of Engineers appointed pursuant to the provisions of act of Congress approved June 3, 1896. Division engineer, Lieut. Col. John Biddle, Corps of Engineers.

Sacramento and Feather rivers, California.—The first appropriation by Congress was " for the improvement of the Sacramento and

Feather rivers, California." This appropriation was made March 3, 1875. At that time, due largely to the consequence of hydraulic mining, the depth on some of the bars in the Sacramento River in the 61 miles between its mouth, at Collinsville, and the city of Sacramento was but 4 feet, as compared with the depth of 7 feet which had previously existed. From Sacramento to Colusa, 91 miles, the stream was in favorable condition for navigation by boats drawing about 3 feet of water, but in the 110 miles from Colusa up to Red Bluff navigation was, as it is yet, difficult at numerous places on account of its changing and crooked channels, easily eroded banks, bars, and rapids. Many snags are also brought into this portion of the stream annually by high water. The bed of the Feather River had also been so filled up with débris from the hydraulic mines draining into it and its tributaries that navigation in the 30 miles between its mouth in the Sacramento and the head of navigation, at Marysville, was practicable during the higher stages only, usually extending from December to June. The same is true at the present time.

The present project for improvement (Reports of Board of Engineers printed in the Annual Reports of the Chief of Engineers for 1898, pp. 2944–2945, and for 1899, pp. 3171–3181) as adopted by the act of Congress approved March 3, 1899, and by subsequent acts, provides for obtaining and maintaining the following-named channel depths in the Sacramento River, by continuing the work of removing snags and other obstructions, and by the construction of wing dams to concentrate the flow at shoal places, at an estimated first cost of $280,000 and an annual expense of $25,000:

From—	To—	Miles.	Least channel depth to be obtained and maintained.
			Feet.
Mouth of river at Collinsville	Sacramento	61	7
Sacramento	Colusa	91	4
Colusa	Red Bluff	110	3
Total		262	

At the time the reports of the Board of Engineers above referred to were submitted the permanent improvement of the Feather River was not contemplated until the flow of sand and other mining detritus from the Yuba, Bear, and other tributaries should be stopped or the commercial interests involved became greater. Several appropriations have since been made, however, for the improvement of both the Sacramento and Feather rivers.

The sum of $910,438.66 was expended up to June 30, 1908, on both streams in the construction of wing dams, construction and operation of a snag boat and a snag scow, and the closing of several extensive breaks in the levees.

The expenditures have resulted in obtaining and maintaining the projected channel depths in the Sacramento from its mouth up to Colusa, and channel depths of 2 to 2½ feet from Colusa up to Red Bluff.

The following statement shows the present conditions for purposes of navigation of the Sacramento and Feather rivers:

	Sacramento River.	Feather River.
Maximum draft that can be carried at low water.	San Francisco to Sacramento, 7 feet; Sacramento to Colusa, 4 to 5 feet; Colusa to Red Bluff, 2 to 2½ feet.	Mouth of river to Marysville, 1 to 2 feet.
Head of navigation	Red Bluff	Marysville.
Length, in miles, of navigable portions.	Mouth to Sacramento, 61 miles; mouth to Colusa, 152 miles; mouth to Red Bluff, 262 miles.	Mouth to Marysville, 80 miles.

The extreme variation of level of water surface at Red Bluff is about 22 feet, at Collinsville about 8 feet. Tidal influence extends up the Sacramento River to about the city of Sacramento.

The Sacramento River is important as the means for transporting both freight and passengers, steamboats plying regularly all the year round between San Francisco and Colusa, 202 miles, and during about seven months of each year (December to June) between San Francisco and Red Bluff, 310 miles. The Feather River is navigated at irregular times by light-draft steamboats from its mouth up to Marysville.

The freight carried on the Sacramento River during the year ending December 31, 1907, was approximately 400,000 tons, consisting principally of general merchandise and fruit upstream, and grain, fruit, vegetables, cord wood, and brick downstream. Approximately 150,000 passengers were carried during the past year. The average tonnage for the past thirteen years has been about 425,000. The maximum tonnage carried was in 1892, when it amounted to 579,574 tons.

Extensive areas of the land along the Sacramento River are under a high state of cultivation. Practically all of the territory along the river is dependent entirely upon the stream as a means of transportation for passengers and freight. In some instances the lower rates of the steamboat lines are met by railroads between the few points where the two meet in competition. Several new steamboat lines, both freight and passenger, were established during the past year. The traffic on the Sacramento is now handled by about 35 steamboats, 50 gasoline boats and launches, and 35 barges, and, in the lower portions of the stream, by a number of gasoline and sail schooners.

On April 4, 1908, a steamboat company began to operate a steamboat at irregular intervals between San Francisco and Marysville, on the Feather River.

The existing project as adopted by Congress contemplates that the sum of $25,000 will be provided annually for the improvement of the Sacramento and Feather rivers. The $25,000 mentioned in the appended money statement as a profitable expenditure in fiscal year ending June 30, 1910, is necessary, in addition to the balance unexpended on June 30, 1908, to remove snags, bars, and other obstructions to navigation.

More extended information concerning the Sacramento and Feather rivers and their tributaries may be found in the Annual Reports of the Chief of Engineers referred to in the summary of the annual

report of the California Débris Commission for the fiscal year ending June 30, 1908.

Much of the country along a considerable portion of the Sacramento, Feather, and San Joaquin rivers and their tributaries is subject to widespread overflow during the winter and spring months of each year, the streams being unable to carry off the rainfall in the valleys and foothills and the melting snow in the mountains. Unrestricted hydraulic mining in earlier years has contributed largely to the difficulty by filling up the beds of the streams.

The interests of navigation, the problem of flood control, and the control and disposition of mine débris are all inseparably connected. These matters are in charge of the California Débris Commission, and that Commission, in a report dated June 30, 1907 (printed in the Annual Report of the Chief of Engineers for 1907, pp. 2262–2269), in which the various questions are considered, states that dredging is considered the only feasible method.

SACRAMENTO AND FEATHER RIVERS.

July 1, 1907, balance unexpended	$51,335.86
Amount received from sales	47.03
	51,382.89
June 30, 1908, amount expended during fiscal year for works of improvement	31,689.20
July 1, 1908, balance unexpended	19,693.69
July 1, 1908, outstanding liabilities	2,397.28
July 1, 1908, balance available	17,296.41
Amount (estimated) required for completion of existing project	Indeterminate.
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	25,000.00

SACRAMENTO RIVER.

July 1, 1907, balance unexpended	$18,658.24
July 1, 1908, balance unexpended	18,658.24

(See Appendix U U.)

EXAMINATION AND SURVEY REQUIRED BY THE RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

The local officer was also charged with the duty of making a preliminary examination and survey of *Sacramento River, California, from its mouth to Feather River* provided for in the river and harbor act of March 2, 1907, and reports thereon will be duly submitted when received.

IMPROVEMENT OF RIVERS AND HARBORS IN THE FIRST PORTLAND, OREGON, DISTRICT.

This district was in the charge of Lieut. Col. S. W. Roessler, Corps of Engineers, division engineer Northern Pacific division.

1. Coquille River, Oregon.—This stream empties into the Pacific Ocean near Bandon, Coos County, Oreg., about 375 miles north of San Francisco, Cal.

Before improvement the bar channel skirted the south headland and crossed ground which was studded with dangerous rocks. It was also crooked. The depth over the bar was usually about 3 feet at low tide, or a little over 7 feet at high tide. Vessels which crossed the bar could ascend at high tide to the town of Coquille, about 25 miles above Bandon, and light-draft steamers could ascend the stream a farther distance of about 12 miles to the head of navigation at Myrtle Point. The usual range of the tide at Bandon is about 4.2 feet.

The original project of 1878 provided for the construction of two coverging high-tide jetties of rubblestone, by which the ebb flow would be concentrated upon a limited portion of the bar. The projected width apart of the jetties was 800 feet and the expected depth 12 feet at deep low tide.

After the work had been carried to a certain point and the results noted, it was found necessary to reduce the width between the jetties from 800 to 600 feet and to reduce also the depth that would probably result from the improvement to 8 feet at low tide.

These changes and the limitation of the length of the south jetty to 2,700 feet and of the north jetty to 1,575 feet by the act of Congress approved July 13, 1892, constitute the present modified project.

The estimated cost of the project when completed, not including expenditures for maintenance, is $306,200.

The amount expended prior to operations under the existing project was $144,323.42, including $6,883.90 for snagging and $15,000 for repairs and maintenance.

The amount expended on the present project to the close of the fiscal year 1908 was $179,662.90, of which approximately $39,960.74 was applied to maintenance.

To date the south jetty has been constructed to its full length of 2,700 feet and the north jetty to a length of 1,440 feet. The effect has been the closing of a dangerous channel and the development of a new channel straight out to sea, with a controlling bar depth of 10 feet at mean low tide. During the year 22,840 tons of rock has been placed in the north jetty and this jetty extended seaward a distance of 150 feet.

No additional funds are required for the present project.

The river and ocean form the only practicable means of transporting the commerce, the principal items of which are lumber, coal, live stock, and farm products. This commerce is loaded on small coasting vessels along the 25 miles of river between its mouth and Coquille, and is usually taken to the San Francisco market. The total amount of exports during the calendar year was 60,504 tons, valued at approximately $1,367,634.

References to former reports are given on page 259 of the Annual Report of the Chief of Engineers for 1905, and reference to reports on examination and survey made in compliance with act of March 2, 1907, will be found on page 817 of this report.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.
1898	24,556	.....
1899	26,654	.....
1900	30,727	.....
1901	32,975	.....
1902	37,458	.....
1903	48,249	.....
1904	60,944	$1,322,058
1905	45,455	1,105,750
1906	67,288	1,119,716
1907	60,504	1,367,634

July 1, 1907, balance unexpended	$63,224.01
June 30, 1908, amount expended during fiscal year, for works of improvement	32,210.33
July 1, 1908, balance unexpended	31,013.68
July 1, 1908, outstanding liabilities	10,700.00
July 1, 1908, balance available	20,313.68
July 1, 1908, amount covered by uncompleted contracts	13,448.00

(See Appendix V V 1.)

2. *Entrance to Coos Bay and Harbor, Oregon.*—Coos Bay is a tidal estuary about 180 miles south of the Columbia River. Next to Humboldt Harbor, California, it is the principal harbor between the mouth of the Columbia River and San Francisco Harbor. Before improvement the obstructions to navigation were a shallow and shifting channel across the ocean bar and a shallow harbor channel to the principal wharves of the bay. The depth on the ocean bar was often no greater than 10 feet at low water and the channel of the bar unstable in location.

Under a project of 1879 a low-tide jetty was constructed inside the entrance to reduce the sharpness of the bend around the end of the north spit and incidentally to increase the depth on the bar. The length of this jetty was 1,760 feet and its cost $213,750. The jetty reduced the sharpness of the bend, but did not increase the depth on the bar.

The present project for increasing the bar depth was adopted by Congress in the act of September 19, 1890. It provided for the construction of a north jetty 9,600 feet long and a slightly converging south jetty 4,200 feet long, at an estimated cost of $2,466,412. Both were to be constructed of rubblestone and raised to high-tide level. The depth it was expected to obtain was 20 feet at low tide.

The projected depth was obtained in 1894 before the completion of the north jetty. The position of the channel, which had always been unstable, became fixed in location parallel and close to the north jetty. These favorable conditions have continued to the present day. The south jetty has, therefore, not been built, and the improvement has been made at a fraction of the estimated cost. The expenditures to the end of this fiscal year in original jetty work and in maintenance have been $912,182.99, of which $173,432.99 was for maintenance. In addition to this, $50,890 has been expended in dredging the inner harbor, so as to give a low-water depth of 12 feet to the town of Marshfield.

One feature of the work is the reclamation of the north sand spit by planting Holland grass. One source of the accretions to the bar proper and to shoals inside the bar is the sand that is picked up from the spit and blown into the channel during the prevailing northwest winds of summer. A small amount is planted each year, and the ultimate reclamation of the spit is promising. The only work of the year, besides watching the plant, was the planting of Holland grass.

A pipe-line suction dredge for use on this and other coast harbors of Oregon and Washington is now under construction under an appropriation of $100,000 in the river and harbor act approved March 2, 1907. Pending action by Congress on the recent report for a greater improvement of the bay, it is recommended that the available balance on the jetty appropriation be expended in operating this suction dredge.

The outbound commerce of Coos Bay consists principally of lumber products, coal, farm and dairy produce, live stock, and fish, and amounted during the year to 127,675 tons, valued at approximately $2,576,732. The lumber and coal is a growing and valuable industry, and the tonnage each year is increasing. The inbound commerce, consisting of farm and mill machinery and miscellaneous merchandise, amounted to 39,887 tons, valued at approximately $3,902,290.

San Francisco is the principal market. At present the bay and ocean are the only means of transportation. There is, however, a good prospect that a branch road will be built in the near future to connect with the Southern Pacific system, which, when completed, will further develop the rich timber and mineral resources of the Coos Bay district. The railroad may diminish to some extent the water-borne traffic of the harbor, but it is not believed that the reduction will be enough to affect the standing of Coos Bay as an important seaport.

References to former reports are given on page 611 of the Annual Report of the Chief of Engineers for 1905, and reference to report on examination and survey made in compliance with act of March 2, 1907, will be found on page 817 of this report.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.
1898	103,039	.....
1899	116,567	.....
1900	104,294	.....
1901	97,500	.....
1902	122,232	.....
1903	135,178	.....
1904	136,958	$3,557,984
1905	178,945	3,901,906
1906	184,455	5,900,017
1907	167,562	6,400,000

July 1, 1907, balance unexpended	$25,275.99
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,444.94
July 1, 1908, balance unexpended	23,831.05
July 1, 1908, outstanding liabilities	70.00
July 1, 1908, balance available	23,761.05

(See Appendix V V 2.)

3. Coos River, Oregon.—Coos River is the principal tributary of Coos Bay and empties into the bay at its head, opposite the town of Marshfield. At a point 5½ miles from its mouth the river divides into two branches, known as the North and South forks, up each of which tidal influence extends for about 8½ miles. Before improvement was commenced the small light-draft steamboats and launches plying between Marshfield and the head of tide on each fork experienced considerable difficulty in navigating on account of the many snags, bowlders, etc., in the stream.

The original plan of improvement, based on the survey made in 1894 (Annual Report of the Chief of Engineers for 1895, pp. 3502-3505), proposed the removal of all snags and bowlders from a selected channel 50 feet in width. The estimated cost was $5,000, but in 1898 it was stated in the annual report that $3,000 additional would be required to complete the project, and in 1900 it was estimated that an appropriation of $1,500 every two years would be required for maintenance.

The amount expended on this work up to June 30, 1908, was $14,336.30, of which $6,336.30 has been applied to maintenance.

Carpenters bar and Blaines bar on the South Fork, and Yokans bar and different shoal places on the North Fork, were dredged to a ruling depth of from 4 to 4½ feet at low water during the months of August and September.

The maximum draft that can be carried at low tide over the upper reaches of Coos River is about 1½ feet at low water. The range of tide is about 2½ feet, so that boats drawing 4 feet navigate to head of tide water on both the North and South forks, a distance of about 14 miles above the mouth.

Coos River flows through a narrow but productive valley and is the only means of transportation. The commerce is carried on small steamers to Marshfield, where it is loaded into ocean steamers and taken to San Francisco markets. This commerce is mostly farm and dairy products, logs, and lumber, and amounted during the year, including supplies, machinery, etc., received, to 42,073 tons, valued at approximately $1,613,948.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.
1898	22,674	.....
1899	[a] 70,007	.....
1900	[b] 229,225	.....
1901	62,402	.....
1902	[c] 46,000	.....
1903	28,109	.....
1904	49,907	$1,033,758
1905	44,398	1,179,974
1906	35,537	1,246,684
1907	42,073	1,613,948

[a] Includes 21,852 tons of stone for the Government jetty at the entrance to Coos Bay, Oregon.

[b] Includes 170,400 tons of stone for the Government jetty at the entrance to Coos Bay, Oregon.

[c] Approximate.

July 1, 1907, balance unexpended	$3,633.70
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,970.00
July 1, 1908, balance unexpended	1,663.70
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	1,500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix V V 3.)

4. Tillamook Bay and bar, Oregon.—Tillamook Bay lies on the Oregon coast, about 50 miles south of the Columbia River. It is about 6 miles long by 3 miles across in the widest part. The bar in the ocean at the entrance has generally a controlling channel depth of about 14 feet at mean low tide. The greater part of the area of the bay itself is taken up by mud flats, which are bare at low tide and separated by four principal channels which shoal to a low-water depth of but 1 or 2 feet near the east end of the bay.

Coasting vessels drawing from 14 to 15 feet can reach Hobsonville, on the north channel, a short distance inside the entrance.

The town of Tillamook, the most populous place on the bay and the distributing point for a very fertile valley, is situated on Hoquarten Slough, about 12 miles from the entrance, and can be reached at high tide by vessels drawing about 10 feet. Originally the controlling high-water depth between the ocean and town of Tillamook did not exceed 7 or 8 feet.

The original project for the improvement of Tillamook Bay was adopted by the river and harbor act of August 11, 1888, and provided for a survey of the entrance and for the improvement of Dry Stocking bar in Hoquarten Slough by the building of pile dikes at an estimated cost of $5,200. The total expenditures on the original project amounted to $5,700.

The existing project, printed in the Annual Report of the Chief of Engineers for 1892, pages 2742–2752, provided for connecting the north and middle channels, nearly opposite Bay City, putting in dikes at Junction and Dry Stocking bars, and contemplated a least depth in the channel of 9 feet at mean high tide from Hobsonville up to Tillamook. The estimated cost was $100,000.

The total amount expended on the work up to the close of the fiscal year ending June 30, 1908, was $123,243.85, of which $50,770.48 was for maintenance and $10,102.50 for dredging, snagging, etc., which resulted in maintaining the projected depth of at least 9 feet in the channel between Bay City and the town of Tillamook.

The work of the season, which consisted in snagging and dredging between May and November, sufficed to maintain the depths theretofore obtained. Work was again resumed in May of 1908 and is in progress at the end of the fiscal year.

The maximum draft that can be carried at low water over the shoalest part of the channel is about 3½ feet. The average range of the tide is 6.2 feet. The head of navigation is Tillamook, about 12 miles from the entrance.

The commerce of Tillamook Bay consists chiefly of lumber and dairy products exported to Portland and San Francisco, and general merchandise brought in by coasting vessels. During the calendar

year this traffic amounted to 22,917 tons, valued at approximately $1,246,710.

There is no railroad in the vicinity at this time, and the bay and ocean afford the only means of transportation. A railroad from Tillaboro to Tillamook Bay has been commenced and the track laid for the first few miles.

References to former reports are given on page 668 of the Annual Report of the Chief of Engineers for 1905, and reference to reports on examination and survey made in compliance with act of March 2, 1907, will be found on page 817 of this report.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.
1898	35,885	.....
1899	36,835	.....
1900	17,640	.....
1901	21,147	.....
1902	24,883	.....
1903	16,862	.....
1904	13,823	$658,489
1905	13,919	669,760
1906	13,627	850,240
1907	22,917	1,246,710

July 1, 1907, balance unexpended	$8,766.66
June 30, 1908, amount expended during fiscal year for maintenance of improvement	6,285.83
July 1, 1908, balance unexpended	2,480.83
July 1, 1908, outstanding liabilities	548.00
July 1, 1908, balance available	1,932.83
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	15,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix V V 4.)

5. Improving the various harbors on the coasts of Oregon and Washington by the construction and equipment of a dredging plant for use thereon.—The harbors and rivers upon which improvements are in progress, or upon which the improvements already completed require periodical work for their maintenance, are Tillamook Bay and bar, Coos Bay and Harbor, Coquille River, Oregon, and Grays Harbor, Willapa Bay, and certain other works in Washington.

For the maintenance and further improvement of these localities the river and harbor act of March 2, 1907, appropriated $100,000 to build a pipe-line suction dredge. A contract for such dredge with an 18-inch suction was made January 24, 1908, for completion September 24, 1908. The dredge is about 75 per cent completed and is promised ahead of the contract time.

The manner in which funds should be provided for operating this dredge has had careful consideration, and it is the opinion of the district officer that the plan of making a lump sum annual appropriation for operation at such points as Congress may authorize, and for such time at each locality as the Secretary of War may approve, is much better than the plan of making specific appropriations for each

locality and paying for the dredging out of such appropriations. This latter plan lacks the flexibility so desirable and necessary in the uncertain work of maintenance and will, it is believed, lead to complications which the first-mentioned plan would avoid. The cost of operation and maintenance of plant is estimated at $5,000 per month for the first three years, and $6,000 per month thereafter.

July 1, 1907, balance unexpended	$100,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	34,460.27
July 1, 1908, balance unexpended	65,539.73
July 1, 1908, outstanding liabilities	31,603.00
July 1, 1908, balance available	33,936.73
July 1, 1908, amount covered by uncompleted contracts	16,702.00

(See Appendix V V 5.)

6. Snake River, Oregon, Washington, and Idaho.—The stretch of river under consideration extends from Pittsburg Landing to its junction with the Columbia, a distance of 216 miles. In recent years little has been done above the city of Lewiston.

The principal obstructions are the numerous rapids and the obstacles which are found in these rapids. The obstacles are projecting points of ledges, gravel shoals, and isolated bowlders. Some of the rapids are practically impassable at extreme low water. A detailed description of the river prior to and during the early years of improvement will be found in the Annual Reports of the Chief of Engineers for 1880, page 2293, and 1891, page 3211.

Special projects for improving certain sections of the river have been submitted and approved from time to time, but there has been no general or continuous project for the improvement of the river as a whole. In 1877 a project was approved for removing reefs and bowlders and for scraping gravel bars in the Columbia and Snake rivers between Celilo, Oreg., and Lewiston, Idaho, a distance of 263 miles, at an estimated cost of $132,000. In 1892 this project was extended to include the improvement of the 7 miles of river above Lewiston to Asotin, Wash., and the act of March 3, 1905, further provided for extending the work of improvement as far as the mouth of Imnaha River.

The operations under this modified project during the past fiscal year have resulted in providing a low-water channel 40 inches deep between Riparia and Lewiston. This is the best channel that has ever been obtained and was susceptible of use throughout the entire season by boats of suitable design for swift and shoal water rivers, but, notwithstanding the good results obtained from the season's operations, navigation was suspended during a portion of the low-water season for the alleged reason that the boats could carry only reduced cargoes and that the boats themselves were subjected to considerable wear and tear. The steamboats now used on this part of the river are owned by the Oregon Railroad and Navigation Company, and are not of suitable design in some respects. Very little navigation has been carried on on the lower portion of the Snake below Riparia since the completion of the paralleling railroad as far as Riparia in 1882. Recently there is a pronounced disposition to revive traffic on this portion of the stream in connection with the

portage road at Celilo, the special object being the establishment of competitive rates. To begin this work the State of Washington has appropriated the sum of $100,000, which is being expended under the direction of this office.

At the beginning of the fiscal year plans were in preparation for three drill scows under the appropriation by the State of Washington. These scows were completed during the year and, jointly with the U. S. steamboat *Wallowa*, were employed in removing obstructing ledges in the worst rapids between Riparia and the mouth of the river. Ledges were removed at Texas Rapids, Hunters Rapids, Palouse Rapids, Monumental Rapids, Pine Tree Rapids, and Fivemile Rapids. Some raking was done on the gravel bars at Texas and Pine Tree rapids. The total work of the season below Riparia consisted in 5,531 linear feet of holes drilled and 3,633 cubic yards of ledge removed. In addition, the dredge *Wallowa* raked several of the worst bars between Riparia and Lewiston, this latter stretch of river requiring but little attention during the year.

The amount expended on the original and modified projects up to the close of the fiscal year 1908 was $258,112.48 under the national appropriation and $47,377.31 under the appropriation of the State of Washington.

The commerce transported on the Columbia and Snake rivers during the fiscal year amounted to 39,228 tons and consisted principally in farm and mill machinery, grain, fruit, and general merchandise. The value of these commodities is estimated at $1,430,300.

References to former reports will be found on page 745 of the Annual Report of the Chief of Engineers for 1906, and a map of the river is published opposite page 1988 of the same report.

Comparative statement of traffic carried on Columbia River above Celilo and on Snake River.

Calendar year.	Columbia River above Celilo.	Snake River.	Total.	Estimated value.
	Tons.	*Tons.*	*Tons.*	
1898			36,923	
1899			45,654	
1900			35,920	
1901			36,723	
1902			37,824	
1903			44,379	
1904			43,547	$1,798,677
1905			28,380	1,191,960
1906			71,556	2,671,882
1907	7,776	39,228	47,004	1,880,300

FEDERAL APPROPRIATION.

July 1, 1907, balance unexpended	$10,180.98
Refundment of overpayment	.75
	10,181.73
June 30, 1908, amount expended during fiscal year for maintenance of improvement	5,923.35
July 1, 1908, balance unexpended	4,258.38
July 1, 1908, outstanding liabilities	10.20
July 1, 1908, balance available	4,248.18

Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	$10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

STATE APPROPRIATION.

July 1, 1907, balance unexpended	$100,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	47,377.31
July 1, 1908, balance unexpended	52,622.69

(See Appendix V V 6.)

7. *Columbia River and tributaries above Celilo Falls to the mouth of the Snake River, Oregon and Washington.*—This stretch of river is 124 miles long and forms a waterway which is susceptible of open-river navigation at favorable stages. The difficulties of navigation are the rapids which abound in this portion of the river, as in the Snake River and still higher reaches of the Columbia. The obstructions are concentrated in the vicinity of the rapids, and these obstructions consist of swift current, projecting ledges which make the channel crooked, isolated bowlders which reduce the available depth, and gravel shoals.

Before the days of railroads this stretch of waterway, in connection with the lower reaches of the Columbia and the portage roads at Celilo and the Cascades, formed the main highway of commerce between eastern and western Oregon, and a large amount of navigation was carried on for that time. This navigation continued until 1882 and was then practically suspended, owing to the paralleling of the river by the Oregon Railroad and Navigation Company's railroad.

In 1872 Congress made its first appropriation for improving the river, and under this appropriation ledges were blasted and bowlders removed from the worst rapids—mainly Umatilla Rapids. In 1877 this project was modified so as to include the Snake River, and under these two projects there was expended up to 1882 approximately $120,000.

After suspending work in 1882, nothing further was done until 1905. By the act of March 3 of that year Congress authorized a survey of the entire stretch of the river with a view to further improvement. The project, which has resulted from this survey and which has been adopted by Congress, proposes to facilitate navigation by removing obstructing bowlders and ledges, and raking gravel bars, and by these works to make safe and available for all but extreme low stages the depths that now exist, rather than to develop any considerable depth at the lowest stage of river. The estimated cost for carrying out this project is $400,000.

The State of Washington has made available the sum of $25,000 for expenditure in the vicinity of Umatilla Rapids.

At the beginning of the fiscal year plans were in preparation under the appropriation by the United States for a steamboat suitably equipped for drilling ledges and raking gravel bars. Contract for this steamboat has been let and the boat was approximately 50 per

cent completed at the end of the fiscal year. A drill scow was constructed during the year under the appropriation by the State of Washington and was employed in removing obstructing ledges near the head of Umatilla Rapids. The scow was in commission from October 19 to March 15, and in that time drilled 2,796 holes and removed 1,206 cubic yards of ledge.

The work for the coming fiscal year will be the completion of the steamboat and its operation on Umatilla and other rapids of the Columbia River between Celilo and the mouth of the Snake, and continuation of the removal of ledges from Umatilla Rapids under the appropriation of the State of Washington.

The amount expended on the present project to the end of the fiscal year ending June 30, 1908, under the national appropriation was $34,051.10, and under the State appropriation was $13,159.66. It is calculated that the project was about 8 per cent completed on June 30, 1908.

The region which this improvement, and the improvements higher up the Columbia and on the Snake River, will benefit is now producing annually an estimated amount of 36,000,000 bushels of wheat, to say nothing of the fruit and cereal products. Of the wheat produced, about 10,000,000 bushels are required for home consumption and about 90 per cent of the remainder, say 22,000,000 bushels, are transported to the coast. The vast areas of desert land now being reclaimed by irrigation will greatly increase this output.

With open-river competition through The Dalles-Celilo Canal, and with the reduction in rail rates which will surely follow, a large saving will result to the shippers of eastern Oregon and Washington. What that saving is likely to be can not be estimated in advance, even approximately. A reduction of 25 per cent in present rates would effect an annual saving of $482,000 on the present shipments of wheat from that source. The commerce handled by the few boats operated consisted principally of wheat, machinery, and general merchandise, and amounted to 7,776 tons during the calendar year 1907, valued at approximately $450,000.

The Open River Transportation Company, organized for the purpose of operating boats on the upper Columbia River, is now negotiating for the construction of two steamers 150 feet in length, with a carrying capacity of 250 tons each.

FEDERAL APPROPRIATION.

July 1, 1907, balance unexpended	$119,045.65
June 30, 1908, amount expended during fiscal year for works of improvement	33,096.75
July 1, 1908, balance unexpended	85,948.90
July 1, 1908, outstanding liabilities	3,259.00
July 1, 1908, balance available	82,689.90
July 1, 1908, amount covered by uncompleted contracts	27,622.00
Amount (estimated) required for completion of existing project	280,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	75,000.00

STATE APPROPRIATION.

July 1, 1907, balance unexpended	$25,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	13,159.66
July 1, 1908, balance unexpended	11,840.34
July 1, 1908, outstanding liabilities	618.00
July 1, 1908, balance available	11,222.34

(See Appendix V V 7.)

8. Columbia River between the foot of The Dalles Rapids and the head of Celilo Falls, Oregon and Washington.—There are four obstructions:

First. Threemile Rapids, 3 miles above the city of The Dalles. While the current here is swift, the obstacle before improvement was a channel both crooked and narrow.

Second. Fivemile Rapids (The Dalles), where for 1½ miles the river flows with high velocity between precipitous basaltic walls 150 to 200 feet apart. The rapids are an absolute barrier to navigation of any kind.

Third. Tenmile Rapids, a gorge half a mile long similar to Fivemile Rapids, but not so swift or turbulent.

Fourth. Celilo Falls, where there is a sheer fall of 20 feet at low water.

To overcome the last three barriers, Congress authorized a boat railway in the act approved August 18, 1894, but the railway was not built. A later project provided for short canals with locks at Fivemile Rapids and at Celilo Falls.

The present project, as adopted by Congress in the act approved March 3, 1905, provides for a continuous canal on the Oregon shore between the pool above Celilo and the pool below Fivemile Rapids, and open-river improvement at Threemile Rapids. As subsequently modified in minor details, the approved canal will have a depth of 8 feet, width of 65 feet at bottom, and length of 8½ miles, with five locks 300 feet by 45 feet by 7 feet over miter sills, two of which will be located at lower end of the canal, one at Fivemile Rapids, one at Tenmile Rapids, and one at Celilo Falls. A recent revision based on accurate surveys has resulted in reducing the curvature of the canal trunk at a number of points. The same revision contemplates omitting heavy masonry walls on gravel and sand foundations, and using in such localities ordinary levee embankments made water-tight by a lining of concrete. The estimate of cost has also been revised to allow for the difference between the assumed prices for labor and material in the original estimate and the higher prices prevailing at the present time. In round numbers the present estimate is $4,900,000, as against $4,125,000 in the original estimate.

Two contracts were in force at the beginning of the fiscal year. The first contract, which was dated April 12, 1904, provided for blasting out rock ledges in the vicinity of Threemile Rapids so as to give a channel at least 10 feet deep at low water for a width of 200 feet at one point and 250 feet at other points. Fifty thousand nine hundred and seventy cubic yards of rock was removed under this contract. The contract was completed in March, 1908, and final payment made.

The second contract was dated August 10, 1905, and provides for constructing one boat basin and one lock chamber at Celilo, but not the lock gates nor the maneuvering machinery. The contractors, Messrs. Smyth & Jones, have made very slow progress, accomplishing less than one-half of the contract requirements before the expiration of the time limit, January 1, 1907. Owing to the fact that the section of canal under construction will be of no benefit until the entire canal is completed, and also to the fact that the prices are very favorable to the United States, the time limit was waived and the contractors allowed to go on with the work. During the year they have placed 14,746 cubic yards of concrete, 1,299 cubic yards of riprap, 45,873 pounds of reenforcing rods, and removed 6,965 cubic yards of solid rock, 16,689 cubic yards of common excavation, and 1,015 cubic yards of sand. The work was suspended in April on account of the summer freshet. It is expected that work will be resumed about August and that all of the work under the contract will be completed during the working season.

The amount expended on previous projects was $27,112.83, and on the present adopted project to June 30, 1908, was $392,136.92, of which $31,279.81 was applied to surveying, preparing plans, etc., before its adoption.

After allowing for the completion of the present contract there will remain a balance of approximately $200,000 from previous appropriations, $336,000 provided by the sundry civil act of May 27, 1908, and an unappropriated balance of $164,000 authorized by the act of March 2, 1907, total $700,000, under which another contract will be made covering the construction, save the concrete lining, of about 14,400 feet of canal trunk in extension of the work now in progress at Celilo. Specifications for this extension have been prepared and bids therefor will be opened after the present freshet has subsided.

The amount estimated as a profitable expenditure to June 30, 1910, includes $164,000 still unappropriated and pledged by act of March 2, 1907. It is recommended that the work be placed on a continuing-contract basis, with authorization to expend $1,000,000 per year until the work is completed. If this is not done an appropriation of $1,000,000 is recommended for the fiscal year ending June 30, 1910. in addition to the $164,000 heretofore pledged but not yet appropriated.

The fluctuation in water surface from extreme low water to extreme high water varies from 32 to 90 feet at different points in the short stretch of river from Celilo to The Dalles. River boats can now reach Big Eddy, nearly 4 miles above The Dalles, at favorable stages, and a limited amount of freight has been transferred between steamers and the portage railway at Big Eddy, and between the portage road and a single steamer operating during the past season above Celilo. The influence of this traffic has already resulted in a reduction of the freight rates as far as the traffic over the portage road and its connecting steamer above has extended, and a still further reduction is anticipated as the steamboat service on the upper river is increased.

The benefits to be derived from the completion of the proposed improvement, the country to be affected, and the probable resources to be developed, with maps, etc., are given in House Document No. 228, Fifty-sixth Congress, second session. Irrigation projects now

contemplated should within a few years further increase the farm products, and it is expected that the improvement will reduce present freight rates on large quantities of produce annually shipped by rail from the extensive territory drained by the upper Columbia and Snake rivers.

Since the last annual report the Spokane, Portland and Seattle Railway Company, a corporation under the joint control of the Northern Pacific and Great Northern Railway companies, has completed a line of road along the north bank of the Columbia River between Kennewick, Wash., and Vancouver, Wash., and will soon complete the bridges across the Columbia and Willamette rivers, giving entrance to Portland, Oreg.

References to former reports are given on page 673 of the Annual Report of the Chief of Engineers for 1905.

Comparative statement of traffic handled by Oregon State Portage Railway between Big Eddy and Celilo, Oreg.

Calendar year.	Tons.	Estimated value.
1905	3,058	$185,800
1906	5,414	227,900
1907	4,600	185,000

July 1, 1907, balance unexpended	$462,696.40
Amount appropriated by sundry civil act approved May 27, 1908	336,000.00
Received from sales of blueprints	9.95
	798,706.35
June 30, 1908, amount expended during fiscal year for works of improvement	131,941.25
July 1, 1908, balance unexpended	666,765.10
July 1, 1908, outstanding liabilities	16,270.00
July 1, 1908, balance available	650,495.10
July 1, 1908, amount covered by uncompleted contracts	100,888.00
Amount (estimated) required for completion of existing project	3,872,392.64
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	[a]1,164,000.00

(See Appendix V V 8.)

9. Canal at the Cascades, Columbia River, Oregon.—This improvement embraces about 4½ miles of the Columbia River where it passes through the Cascade Mountain Range and where it is contracted into the narrow width of a gorge with steep slope and swift current. A fall of 24 feet at low water and a lesser fall at high water in the upper 2,500 feet of the gorge creates a fearful rapid, whose swift current, rushing over many obstructing bowlders, effectually bars upstream navigation and renders downstream navigation unsafe. In the lower 4 miles of the gorge the river is not so narrow and the

[a] Of this amount $164,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907.

current not so swift as in the upper half mile; but even here navigation was unsafe in the unimproved river by reason of obstructing ledges and bowlders, upon which vessels were liable to be swept by a very swift current. The improvements made consist in the construction of locks around the steep rapids at the upper end of the gorge and in open-river work, such as blasting out ledges and bowlders in the lower 4-mile section.

The original project was for a canal and locks around the falls and was adopted in 1877 and modified in 1886 and 1888, and included the improvement of the rapids below the falls to secure a low-water channel of 8 feet. The locks were about 462 feet long and 92 feet wide, with a low-water depth of 8 feet over the miter sills.

The project was again modified in 1894 to provide for utilizing the upper 426 feet of the uncompleted canal above the lock gates as a second lock. It provided for raising the protection work of the canal walls as a safeguard against flood waters, which in that year reached a height of 6 feet above previous known high water.

The estimated cost of the original project was $2,544,545, and of this latter modification $413,360.

The canal and locks were first opened to navigation in the fall of 1896, with walls and slope revetments still incomplete.

The amount expended on the original and modified project in constructing the locks and the necessary keepers' dwellings and other buildings was $3,819,139.73.

The amount required to complete the locks and put the grounds in good condition is $199,260. This work includes the building of the land wall of the upper lock, constructing three sets of steps, and completing the paving and grading on the land side of the canal. Provision should be made for the erection of an office building and the blasting out of some obstructing ledges below the locks, and future appropriations will be applied to that purpose.

The expenditures during the fiscal year were on account of care and maintenance of works and plant used during construction.

The head of navigation for boats passing the locks has heretofore been Threemile Rapids, 1½ miles above The Dalles, but may now be said to be at Big Eddy by reason of the improvements already made under the contract for removing dangerous rocks at Threemile Rapids (see report on improving Columbia River between the foot of The Dalles Rapids and the head of Celilo Falls, Oregon and Washington, on page 811 of this report).

The maximum draft that can be carried through the locks at the close of the fiscal year is about 6.5 feet at low water, owing to deposit on the canal floors.

The yearly rise in the Columbia takes place in May, June, or July, and its usual height above extreme low water is about 40 feet.

The down-river commerce through the locks consists principally of wheat, flour, miscellaneous grain, cattle, horses, wool, and country produce. The amount of this commerce for the fiscal year was 24,537.98 tons, valued at approximately $1,472,242.

The up-river commerce is principally general merchandise, machinery, and railroad supplies, consisting of 30,416.19 tons, valued at approximately $1,824,998.

References to former reports are given on page 675 of the Annual Report of the Chief of Engineers for 1905.

Comparative statement of traffic.

Fiscal year ending June 30—	Tons.	Estimated value.	Number of passengers.
1899	16,700	.....	23,908
1900	17,710	.....	30,639
1901	22,426	.....	34,762
1902	19,710	.....	52,720
1903	36,181	.....	50,821
1904	31,967	.....	76,971
1905	35,166	$2,286,125	64,403
1906	46,884	2,813,040	133,070
1907	53,770	3,226,200	89,239
1908	54,954	3,297,240	86,615

July 1, 1907, balance unexpended	$2,259.85
June 30, 1908, amount expended during fiscal year for maintenance of improvement	770.10
July 1, 1908, balance unexpended	1,489.75
July 1, 1908, outstanding liabilities	60.00
July 1, 1908, balance available	1,429.75
Amount (estimated) required for completion of existing project	199,260.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	108,500.00

(See Appendix V V 9.)

10. Operating and care of canals and locks at the Cascades of the Columbia River, Oregon.—The canal and locks around the obstructions in the Columbia River at Cascades, Oreg., were so far completed that they were opened to navigation on November 5, 1896, since which time appropriations have been made under the general work of improvement for further completing the walls and slope pavement, grading, etc. A general description of the location, dimensions, etc., is given in the preceding report.

From the opening of the locks there has been a gradual accumulation of sand and silt from year to year in the upper entrance and a corresponding gravel deposit at the lower. For the nine years following the opening of the locks these deposits were not troublesome, but they have been during the past three years. Some dredging has been done, but not in sufficient amount to prevent more or less delay and inconvenience to the passing of boats at low water. In the fall of 1907 the river reached an unusually low stage, and the deepest boat plying this portion of the river was unable to load to full depth because of the accumulation of silt in the upper entrance. The amount of material to be removed is approximately 50,000 cubic yards, and the equipping of a proper dredge and the dredging will cost approximately $14,000. Upon request of the district officer an allotment of that amount has at this writing been made, and steps have been taken to prepare a dredging plant for this work before the low-water season sets in.

During the fiscal year the sum of $14,569.34 was expended for dredging in the canal entrances and in keeping up general repairs to the operating machinery, grounds, and buildings.

The total amount expended from the indefinite appropriation for operating and caring for the locks and in making repairs to the machinery, valves, etc., to the end of the fiscal year 1908 was $98,646.88.

The commerce through the locks during the fiscal year amounted to 54,954.17 tons, valued at approximately $3,297,240. This commerce consisted principally of wheat, flour, miscellaneous grain, cattle, horses, wool, country produce, general merchandise, machinery, and railroad supplies, a detailed statement of which is given in the district officer's report.

(See Appendix V V 10.)

11. Columbia River between Vancouver, Wash., and the mouth of Willamette River.—Vancouver, Wash., is on the Columbia River 103 miles above its mouth and 5 miles above the mouth of the Willamette River. At low water the tidal influence is felt to the extent of eight-tenths of a foot oscillation. The average summer freshet, which culminates in June, rises to a height of 20 feet above low water. Before improvement vessels drawing 23 feet could come within 2½ miles of the town, but no farther because of a sand bar which had but 9 feet depth at low water. This bar was the result partly from an excessive width in the main river and partly from a diversion of a portion of the river flow around Hayden Island.

Under a project of 1892 the flow around Hayden Island was checked by the construction of a pile, brush, and stone dike about 3,000 feet long across the island chute and a corresponding amount of flow was concentrated in the main channel across the obstructing bar. Improved depth resulted but not sufficient to allow the passage of schooners and other vessels of about 20 feet draft. To obtain the increased depth desired dredging has been resorted to under authority of the act approved March 3, 1905, which provided for the maintenance of a channel 20 feet deep at low water and 150 feet wide. The estimate was $60,000 for original work and $10,000 yearly for maintenance.

Under the modified project the channel was dredged in 1905 to the desired width and depth. The dredged channel received a deposit of 5 to 6 feet depth during the freshet of 1906 and was restored to the original depth by the removal in the following fall of 253,000 cubic yards of sand at an approximate cost of 4 cents per cubic yard. During the freshet of 1907 the channel filled up again and shoaled to a depth of 12 feet at low water. No dredging, however, was done during the fall and winter of 1907–8 owing to the sinking by collision of the dredge *Portland* of the Port of Portland, which had done the dredging from the beginning and had been relied upon to do it again. Under funds now available the channel will be redredged after the present freshet and this redredging will be necessary each year.

The annual maintenance is estimated at $10,000 a year and that amount is requested for the fiscal year ending June 30, 1910.

The dike is in good condition.

The total amount expended on the original and modified projects to June 30, 1908, was $143,014.08, of which sum $45,480.92 was applied to maintenance.

Steamboats drawing 8 feet can navigate the river as far as The Dalles, about 210 miles from its mouth, by passing through the locks at the Cascades.

Vast forests of virgin timber are within easy reach of Vancouver, and the country also produces great quantities of fruit, hay, grain, etc.

The deep-sea tonnage from Vancouver is lumber, shipped principally by coasting vessels, and during the calendar year 1906 amounted to about 7,250,000 feet, valued at approximately $110,000.

The Spokane, Portland and Seattle Railway Company, a corporation under the joint control of the Northern Pacific and Great Northern Railway companies, has completed a line of road along the north bank of the Columbia River between Kennewick, Wash., and Vancouver, Wash., and will soon complete the bridges across the Columbia and Willamette rivers, giving entrance to Portland, Oreg.

References to former reports are given on page 677 of the Annual Report for 1905.

July 1, 1907, balance unexpended	$10,527.06
June 30, 1908, amount expended during fiscal year for maintenance of improvement	540.14
July 1, 1908, balance unexpended	9,986.92
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix V V 11.)

EXAMINATIONS AND SURVEYS MADE IN COMPLIANCE WITH THE RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and surveys required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination and survey of Coquille River, Oregon, with a view to the removal of shoals and rocks at its mouth.—Reports dated March 23 and October 11, 1907, respectively, are printed in House Document No. 399, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $27,840 is presented.

2. Preliminary examination and survey of Tillamook Bay and bar up to the town of Tillamook, Oreg.—Reports dated March 27, 1907, and February 13, 1908, are printed in House Document No. 965, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $5,000 is presented.

3. Preliminary examination and survey of Coos Bay and bar entrance, Oregon.—Reports dated March 26, 1907, and February 19, 1908, are printed in House Document No. 958, Sixtieth Congress, first session. A plan for improvement at an estimated cost of $500,000 is presented.

IMPROVEMENT OF RIVERS AND HARBORS IN THE SECOND PORTLAND, OREGON, DISTRICT.

This district was in the charge of Lieut. Col. S. W. Roessler, Corps of Engineers, division engineer, Northern Pacific division.

1. Willamette River above Portland, and Yamhill River, Oregon.—Before the days of railroads, navigation was carried to the farthest possible points on the Willamette River and its main tributaries, the Long Tom and Yamhill rivers. Navigation was then carried on in the lower stretch of Long Tom River, in the Yamhill River to McMinnville, and in the Willamette River to Eugene, 172 miles from Portland. In the upper stretches navigation could be attempted only during medium and high stages of rivers. Since the construction of railroads navigation has ceased in Long Tom, in the Yamhill except a stretch of 8 miles above its mouth, and in the Willamette above Corvallis, 119 miles from Portland. Occasionally boats still go to Harrisburg, 152 miles from Portland, but this navigation is not profitable on account of steep slopes and swift current. Under improvements heretofore made and annually maintained the Willamette is navigable at medium stages to Corvallis, 119 miles from Portland, and during low water to Independence, 83 miles from Portland, while the Yamhill is kept open to Dayton, 8 miles above its mouth.

The original project, adopted in 1870, has been successively modified in 1878, 1896, and 1904, as modifications have been desirable to meet changed conditions.

The project of 1904, under which operations are now carried on, contemplate the creation and maintenance, by bank revetment, contraction dikes, dredging, and snagging, of a low-water channel 12 feet deep from Portland to Oswego (8 miles), and 2½ to 3½ feet deep from Oswego to Corvallis on the Willamette, and to Dayton on the Yamhill River. Snagging only is contemplated above Corvallis and that is not often required.

The operations of the low-water season of 1907 consisted in dredging shoal gravel bars, removing snags, and repairing dikes and revetments, and resulted in maintaining navigation throughout the year during an exceptionally low-water season.

The annual maintenance is estimated at $30,000, and this amount will be required for the fiscal year ending June 30, 1910. A further appropriation of $10,000 is recommended for constructing a revetment opposite Albany, where the river threatens a cut-off to the injury of the main channel, and for extending the revetment at Independence.

The amount expended on the original project was $247,747.51. The amount expended on the project of 1896 and the present revised project of 1904 up to the close of the fiscal year ending June 30, 1908, was $376,061.62. This amount includes $3,000 expended on the improvement of the Long Tom River and $153,440.94 for maintenance.

The variation of level of water surfaces on the Willamette at Salem from extreme summer low water to winter high water is 23 feet, and on the Yamhill below the lock and dam 35 feet.

The commerce of the Willamette Valley consists of farm products, which are raised on the rich land adjacent to the river and generally shipped to the Portland market. The adjacent forests also produce a large supply of logs and timber, which is brought down to the river

in annually increasing quantities, the products being either shipped by boat or floated to the sawmills along the river or to the paper-pulp mills at Oregon City.

The amount of traffic on the Willamette River above Portland during the calendar year 1907, including saw logs towed, was 412,846 tons, valued at approximately $8,193,746. Of this traffic, 96,425 tons, valued at approximately $3,852,323, including a large percentage of logs, was handled above the locks at Oregon City.

This improvement affords water transportation for a large part of the commodities produced in the valley, and is instrumental in reducing freight on railroad shipments from valley points. Lines of the Southern Pacific Railway Company practically parallel the river on each side, and an electric line has been completed during the year between Portland and Salem.

References to former reports are given on page 680 of the Annual Report of the Chief of Engineers for 1905.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Passengers.
1898	112,154		67,524
1899	117,782		50,738
1900	182,458		47,324
1901	191,901		103,971
1902	192,227		95,221
1903	236,823		66,510
1904	332,130	$11,260,196	65,947
1905	362,258	12,119,596	67,396
1906	383,911	7,591,623	41,160
1907	412,846	8,193,746	41,998

July 1, 1907, balance unexpended		$59,356.64
Refundment of overpayment		.50
		59,357.14
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$17,000.00	
For maintenance of improvement	22,648.82	
		39,648.82
July 1, 1908, balance unexpended		19,708.32
July 1, 1908, outstanding liabilities		2,224.00
July 1, 1908, balance available		17,484.32
Amount (estimated) required for completion of existing project		103,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		40,000.00

(See Appendix W W 1.)

2. Operating and care of lock and dam in Yamhill River, Oregon.—The Yamhill lock, completed in 1900, is situated on Yamhill River, 8 miles above its mouth and 10 miles below the head of navigation at McMinnville.

The total traffic through the lock during the year was 2,020.75 tons of freight and 80 passengers. The freight was largely log rafts

and some pulp wood on barges. The largest year's traffic (1901) was 2,455 tons miscellaneous freight and 1,199 passengers. Steamer traffic has been practically abandoned since 1902, and the reason given is that the steamers formerly employed on the Yamhill find more profitable business on the Willamette. It is claimed by steamboat interests that the uncertainty of lock operations during the freshet season of winter makes it impossible to compete with the railroad rates.

During the year there was expended in operation of lock, care, and minor repairs $1,687.10, a part of which was on account of outstanding liabilities incurred the previous year.

The total amount expended to the end of the fiscal year 1908, including the like expenditures of previous years, is $36,183.21.

(See Appendix W W 2.)

3. Columbia and Lower Willamette rivers below Portland, Oreg.—A project of 1877 provided for dredging a channel to a depth of 20 feet at low water. A modification of this project in 1891 provided for a further deepening of the channel to a low-water depth of 25 feet, mainly by dredging, and a State organization entitled the "Port of Portland Commission" was organized to assist in this work. The act of June 13, 1902, adopted a project which contemplates a large amount of contraction dikes, in addition to dredging, in order to make the 25-foot channel more or less permanent and diminish the annual dredging required. The estimated cost of this latter project was $2,971,300.

Up to this time only a very small number of dikes have been built, owing to the lack of appropriations in sufficient amount to undertake this part of the improvement in a systematic manner. The improvement has been mainly carried on and maintained by annual dredging. The dredging of late years has been done by the U. S. suction dredge *W. S. Ladd*, operating in the lower estuary, and two large pipe-line suction dredges of the Port of Portland Commission. These latter have been operated at the expense of the United States when funds were available, at other times at the expense of the Port of Portland. The result of the combined operations of these three dredges has been to maintain a channel which, allowing for tide, has always been able to pass vessels of 25 feet draft. The ruling depth at the end of the fiscal year was about 22 feet at low water, with a single point near Astoria having a depth of only 20 feet, but as the Columbia River is still in freshet the actual available depths are nearer 27 or 28 feet. As usual the dredges will be put to work and dredge the shoalest places before the river reaches a low stage.

The amount expended prior to 1877 was $221,780.46; from 1877 to adoption of present project was $1,080,874.11, and on the present project to end of the fiscal year 1908, exclusive of dredge construction, $467,048.49.

The act of March 2, 1907, appropriated $300,000 for constructing and operating a dredge. This dredge is under construction on the Atlantic coast and will be delivered here during the coming fiscal year. The amount expended on her construction to June 30, 1908, is $179,723.38, and details of the work are given in Appendix H 9.

The work of the past fiscal year consisted in removing an obstructing pile and stone dike near the mouth of the Willamette River,

repairing stone revetment of Coon Island and dredging by the U. S. dredge *W. S. Ladd* in the lower reaches of the estuary, and by the dredges of the Port of Portland in the upper reaches of the ship channel. The *W. S. Ladd* removed during the year a total of 472,998 cubic yards, and the two dredges of the Port of Portland 2,012,000 cubic yards. The expense of the operations of the Port of Portland dredges was borne by that organization, there being no United States funds available.

The betterment of the channel by dredging is necessary pending the construction of permanent works of contraction. The estimate below provides only for maintenance of a 25-foot channel, an estimate for beginning dike construction being deferred in order that other works of a special character, such as the construction of The Dalles-Celilo Canal and the purchase of the private locks and canal in the Willamette River at Oregon City, may be provided for by adequate appropriation or by authorization of continuing contracts. When these latter have been cared for, the permanent improvement of the lower Columbia by construction works should be undertaken.

The two channels around Swan Island below Portland originally divided the current of the river to the detriment of both. A shoal bar existed at the head of each channel. To remove that of the east channel a dike was constructed across the head of the west channel. The east channel, which is used by all vessels, is very crooked at one portion, and it is sometimes difficult to avoid collision between deep-sea vessels and log tows; the latter are the main source of worry to the deep-sea navigators in the Swan Island channel. There is a general desire to have the west channel dredged out to a sufficient depth to accomodate log tows. This improvement is deemed a necessary one in view of the increasing commerce of this port. In making appropriation for the improvement of the ship channel, it is recommended that so much of the money as may be necessary be authorized for dredging out the west channel to such extent as may be necessary to accommodate log tows. A gap 300 feet wide has been left in the dike in the west channel to permit the passage of shoal-water boats.

The head of deep-sea navigation for ships crossing the bar at the mouth of the Columbia is at Portland, Oreg., on the Willamette River, 110 miles above the mouth of the Columbia. From the latter place light-draft river boats ascend the Willamette River for 150 miles. From the mouth of the Willamette, by using the State portage road, 12 miles in length, the Columbia and Snake rivers are navigable for light-draft river boats at low water to a point on the Snake River about 473 miles from the mouth of the Columbia.

It is not believed that the completion of the project will affect freight rates, but the improvement has been a benefit to shipping, in reducing delays to the deep-draft vessels using the channel.

The export commerce using this waterway consists principally of grain and lumber, while the imports are, in a great measure, composed of the products of the oriental countries, also cement, coal, lime, sulphur, etc. The light-draft tonnage consists mostly of dairy, farm, and lumber products, also miscellaneous machinery and mercantile supplies.

The total commerce handled during the calendar year 1907 amounts to 4,251,681 tons, estimated at approximately $76,583,804.

References to former reports are given on pages 683 of the Annual Report of the Chief of Engineers for 1905.

Comparative statement of traffic.

Calendar year.	Handled by river vessels.		Handled by seagoing vessels.				Handled by river and seagoing vessels.	
	Quantity.	Estimated value.	Receipts.	Shipments.	Total.	Estimated value.	Quantity.	Estimated value.
	Tons.		*Tons.*	*Tons.*	*Tons.*		*Tons.*	
1898	1,121,161	.....	27,776	488,818	515,594	.....	1,637,755	.....
1899	1,489,708	.....	36,253	336,134	372,387	.....	1,862,095	.....
1900	1,287,582	.....	32,905	489,385	552,290	.....	1,809,872	.....
1901	1,534,780	.....	29,548	639,736	669,284	.....	2,204,064	.....
1902	1,567,336	.....	145,514	985,912	1,131,426	.....	2,698,762	.....
1903	1,596,220	.....	173,006	659,178	832,184	.....	2,428,404	.....
1904	1,905,451	$30,775,609	229,833	548,495	778,328	$27,281,302	2,683,779	$58,056,911
1905	2,313,153	26,712,339	210,026	736,779	946,805	31,786,607	3,259,958	58,498,946
1906	2,331,121	26,377,640	226,656	974,317	1,200,973	34,407,991	3,532,094	60,785,631
1907	2,586,964	31,583,804	572,441	1,092,276	1,664,717	45,000,000	4,251,681	76,583,804

July 1, 1907, balance unexpended		[a] $386,216.75
Received from sale of blueprints		14.35
		386,231.10
June 30, 1908, amount expended during fiscal year:		
For construction of dredge	$178,556.06	
For maintenance of improvement	61,095.14	
		239,651.20
July 1, 1908, balance unexpended		[b] 146,579.90
July 1, 1908, outstanding liabilities		[c] 25,462.18
July 1, 1908, balance available		121,117.72
July 1, 1908, amount covered by uncompleted contracts		[d] 50,997.00
Amount (estimated) required for completion of existing project		2,498,509.93
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908		200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix W W 3.)

4. Mouth of Columbia River, Oregon and Washington.—Before improvement there were at different times from one to three channels across the bar, with depths varying from 19 to 21 feet at low tide in the deepest channel. The channel was also unstable in position and oscillated at intervals within an arc of about 180° between Cape Disappointment and Point Adams.

A project of 1884 provided for constructing a low-tide jetty 4½ miles long out from Point Adams on the south side of the entrance and terminating at a point 3 miles south of Cape Disappointment. The jetty was to consist of a rubblestone enrockment resting upon a foundation course of brush mattresses. A modification of the project in 1893 provided for raising the jetty to a high-tide level and building three groins 500 to 1,000 feet long on its north side. The estimate was $3,710,000.

[a] Including $832.68 in hands of Major Deakyne for dredge construction.
[b] Including $94,779.82 withdrawn by Major Deakyne for dredge construction.
[c] Including $22,647.18 for dredge construction.
[d] For dredge construction.

This jetty was completed, as projected, in 1895, at a cost of about $2,000,000, and closely following its completion an increase of 11 feet in the original depth was realized, giving a low-water depth of 31 feet.

This increased depth was not long maintained. Progressive deterioration soon set in. By 1899 the available depth had lessened to 28 feet, and the channel had shifted into an unstable position 2 miles north of the 1895 channel. By 1902 the depths had decreased to 21 feet at low water.

The question of further improvement was taken up in 1899 and it was recommended the jetty be extended a farther distance of 3 miles. This report was the basis upon which Congress appropriated $250,000 (act of June 6, 1900) for repairing the jetty tramway pending a report and recommendation by a board of engineers.

The report of this Board was approved by the Secretary of War March 16, 1903, and as modified in respect to the height and width on top of the enrockment, constitutes the project under which work is now carried on. It provides for extending the south jetty 2½ miles and for building a north jetty if concentration from the north side of the entrance should be found necessary. The project also provided for a dredge to aid in deepening the channel and keeping it in a fixed position. The estimate for the jetty work and the dredge was $3,715,000.

The construction of the south jetty extension is now in progress. The difficulties encountered in carrying on this work have been fully related in former annual and special reports. These difficulties have arisen from the heavy seas which sweep over the line of the jetty extension and from the weakening of the trestle by the teredo. So active have been the teredo in honeycombing the piles that a trestle from one to two years old, supported by an enrockment only raised to low tide and only 10 feet wide on top, has been on several occasions completely destroyed by the storms of a single winter. The experience acquired, at considerable cost, of course, during the first two years of the work of building the jetty extension, has demonstrated that to hold a trestle long enough to finish the work it is necessary to raise the enrockment to a level of mid tide, or higher, and to give it a width on top greater than the width of the double-track trestle—about 25 feet. The experience of the past winter has demonstrated that an enrockment to mid tide for the whole width of the trestle gives the piles the support they require above the level where the teredo is most active. The enrockment built last calendar year was raised to mid tide for the full width of the trestle, and for the first time in four years the trestle withstood the winter's storms with practically no injury. Three specimens of piles recently taken out of this higher enrockment for examination were free from the slightest trace of the teredo, suggesting the thought that the higher and broader enrockment, compacted by an admixture of small stone, formed a complete barrier to the operations of the teredo. The incident is encouraging and there is now no longer any doubt that the trestle can be maintained until the jetty is finished.

The present fiscal year's work consisted in reerecting a trestle over former years' extension so as to get in more rock and as a stepping stone to the *further* extension contemplated. The driving of piles in *an old enrockment* where the penetration is uncertain and never very

great, and bracing them so as to make the structure rigid enough to safely convey the pile driver and running trains until support can be had from the enrockment is a difficult and dangerous operation, requiring a high order of skill and courage. So far no mishap of any kind has occurred in this difficult trestle building. A serious accident, however, occurred while the pile driver was going out to work one morning, the driver being derailed by a misplaced switch, toppling over with all hands on board, and becoming a complete wreck. The casualties were three lives lost and several severe injuries.

At the end of the fiscal year the trestle had been extended over old enrockment to a point 29,416 feet from the root of the jetty at Fort Stevens and the enrockment brought up to level of an average of 4 feet above low tide to the same point. Before the end of July the end of the old enrockment will be reached and the further extension begun. It is expected to place from 3,500 to 4,000 tons of stone per day from the latter part of July to the end of the working season.

The usual midsummer survey of the bar was made in June. The results are very encouraging. Where several narrow, poorly defined channels existed a year ago there is now a broad channel 6,000 feet wide and 25½ feet deep, excepting at several points where isolated soundings of 24½ and 25 feet were obtained. Another encouraging exhibit is the continuing accretion of sand on both the north and south sides of the jetty. The accretion is very marked.

The dredge *Chinook* has not been used for over three years because her boilers are unsafe. The recommendation of last year for an appropriation of $100,000 to install new boilers and make minor alterations to the upper deck is here repeated, and it is further recommended that a sum of $100,000 be appropriated for operating the dredge. It is the district officer's opinion that with a depth of 25½ feet to operate in, the dredge can be used at almost any stage of tide in fair summer weather, and that the use of the dredge will be beneficial in further deepening the bar and in maintaining the channel in a fixed position.

The amount expended on the work under the original project was $1,968,753.14; on the present project, $3,548,441.14.

The amount named in the money statement as a profitable expenditure to June 30, 1910, includes, first, the balance of the amount authorized under continuing contracts in the act of March 2, 1907, for completing the south jetty, and, second, the sum of $200,000 for repairing and operating the dredge *Chinook*. Later in the working season it will be possible to speak with some certainty how much more the work is costing per linear foot of jetty by reason of the higher and wider enrockment, and the higher prices paid for labor and material. Should an appropriation be required on these accounts, a special estimate will be submitted before the meeting of the next Congress.

A deeper bar channel will admit of the use of ships of greater draft and consequently increased carrying capacity, and will reduce the delays occasioned by rough bar. It is doubtful whether it will have any effect on freight rates.

For commercial statistics see report on improving "Columbia and Lower Willamette rivers below Portland, Oreg."

References to former reports will be found on pages 686–687 of the *Annual* Report of the Chief of Engineers for 1905.

July 1, 1907, balance unexpended		$713,804.64
Amount appropriated by sundry civil act approved May 27, 1908		1,450,000.00
Received from sale of blueprints		19.15
		2,163,823.79
June 30, 1908, amount expended during fiscal year for works of improvement		653,700.73
July 1, 1908, balance unexpended		1,510,123.06
July 1, 1908, outstanding liabilities		183,914.00
July 1, 1908, balance available		1,326,209.06
July 1, 1908, amount covered by uncompleted contracts		999,162.00
Amount (estimated) required for completion of existing project		250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908:		
For works of improvement	$250,000.00	
For maintenance of improvement	200,000.00	
		450,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix W W 4.)

5. Improving Clatskanie River, Oregon.—The Clatskanie River rises in the Coast Range and empties into the Columbia River 65 miles below Portland Oreg. The head of navigation is the town of Clatskanie, 3 miles above the mouth, from which large quantities of lumber and shingles are shipped by water. This stretch of river is tidal with a variation of water level due to tides only of about 5 feet and due to tides and Columbia River freshets 10 feet.

Before improvement the obstructions to navigation were a single shoal with but 2 to 3 feet of water on it near the mouth of the river and a narrow and tortuous channel around two sharp bends.

A project adopted by the river and harbor act of March 3, 1899, provided for dredging this shoal and cutting off two sharp bends by means of cut-off channels, at an estimated cost of $13,000. This improvement has been completed and has resulted in giving a depth of 5 feet over the shoalest place and in making the channel to Clatskanie shorter and easier of navigation.

The work done during the fiscal year was the redredging of the shoal below Clatskanie at a cost of $588, which included all the expenditures made during the fiscal year. The amount expended on the project to June 30, 1908, was $12,675.47, of which $868.10 was applied to maintenance. The result accomplished was the restoration of the channel to a depth of 4 feet.

The commerce of Clatskanie River consists of sawmill products, farm products, and general supplies. During the calendar year 1907, this commerce aggregated 22,925 tons, valued at approximately $280,616.

The Astoria and Columbia River Railroad crosses the valley near the town of Clatskanie, but the river does the bulk of the business because it is the cheaper route of transportation.

References to former reports are given on page 688 of the Annual Report of the Chief of Engineers for 1905, and on page 765 of the Annual Report for 1906.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Passengers.
			Number.
1898	153,257	.....	12,250
1899	68,126	.....	5,210
1900	88,622	.....	5,305
1901	51,967	.....	2,136
1902	23,790	.....	1,180
1903	25,765	.....	494
1904	18,861	$444,210	825
1905	16,408	612,970	.....
1906	10,339	216,630	.....
1907	22,925	280,616	502

July 1, 1907, balance unexpended	$912.53
June 30, 1908, amount expended during fiscal year for maintenance of improvement	588.00
July 1, 1908, balance unexpended	324.53
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908	500.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix W W 5.)

6. Cowlitz and Lewis rivers, Washington.—(a) Cowlitz River.—The Cowlitz River rises in the Cascade Range and flows in a southerly direction and empties into the Columbia 64 miles from the sea. The extreme head of navigation is about 10 miles above Toledo, or 46 miles above the mouth. For a stretch of 36 miles downstream from this point the stream is tortuous and nontidal, abounds in numerous sand and gravel bars, is frequently obstructed by snags, and is navigable at medium and the lower stages by small light-draft boats only. On this portion of the river a single boat makes three trips weekly each way.

The lower 9 miles of the river is tidal, with a rise in the tide of zero at the upper end to 4 feet at the mouth. This portion of the river is also narrow and tortuous, but has a better ruling depth than the nontidal section. As in the upper part of the river, the lower 9 miles is obstructed by sand and gravel bars and snags. The river is liable to freshets 22 feet or more in height during the winter season.

Kelso, containing 1,500 inhabitants, and located 4½ miles above the mouth of the river, is the principal business town of the valley. It is the center of a large lumber and shingle manufacturing industry, and the point at which a large number of log and pile rafts are made up for towage to Portland and other points.

The original project for the river's improvement was adopted in 1880, and was designed to aid navigation by the deepening of sand bars and the removal of snags, at an estimated cost of $5,000 the first year and $2,000 for succeeding years.

The appropriations made for this work have been expended from time to time in snagging and blasting out obstructions and in later years in opening some of the more troublesome bars by dredging. The expenditures to the close of the fiscal year 1908 amounted to $51,228.33, of which sum $46,229.33 may be regarded as applied to maintenance.

The expenditures during the fiscal year were applied to snagging and dredging and in constructing 1,150 linear feet of gravel sill and bank revetment to prevent the formation of a cut-off channel in the vicinity of Castlerock, where much damage was done by the great freshet of the winter of 1906–7.

The project, except as to maintenance, has been considered completed. The maximum draft that could be carried over the shoalest place at the close of the year was approximately 14 to 16 inches. Kelso and Castlerock, the principal towns on the river, are also on the main line of the Northern Pacific Railway, and the river is a great factor in regulating freight rates on shipments from those places to competing points on the river. The products of the valley are marketed principally at Portland, and are usually handled by the river boats.

The available balance and the appropriation recommended will be applied to snagging and dredging operations for maintenance of the improvement.

The traffic consists of lumber and farm products and general merchandise, of which 66,424 tons was handled during the year 1907, valued at approximately $3,390,000. In addition to this tonnage 99,156,000 feet B. M. of logs was floated down the stream, having an estimated value of $330,780.

Reference to former reports is given on page 689 of the Annual Report for 1905.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Passengers.
			Number.
1898	16,210		
1899	26,511		
1900	17,279		
1901	14,211		
1902	15,932		
1903	41,515		
1904	26,120	$1,069,020	6,875
1905	46,646	1,494,260	6,000
1906	56,109	2,055,460	1,117
1907	66,424	3,390,000	759

This statement does not include 99,156,192 feet B. M. (110,260 tons) of logs sent down this stream in 1907, having an estimated value of $330,780.

July 1, 1907, balance unexpended	$12,891.75
June 30, 1908, amount expended during fiscal year for maintenance of improvement	11,470.08
July 1, 1908, balance unexpended	1,421.67
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

(*b*) *Lewis River.*—Lewis River, Washington, empties into the Columbia River 25 miles from Portland and 14 miles below the mouth of the Willamette. At a point 3¾ miles from its mouth it

[a] See consolidated money statement on page 829.

divides into the North and East forks. Woodland, on the North Fork, 7½ miles from the mouth, and La Center, on the East Fork, 7 miles from the mouth, are the heads of navigation.

The lower stretches are tidal during low-water periods of the Columbia with an average variation of 2 feet at the mouth, 1¼ feet at La Center, and no variation at Woodland. In freshet periods of the Columbia, the river is subjected to back water, 15 to 20 feet in height, from the Columbia, at which time the water spreads over a large area of bottom land.

At average low stage there was a navigable depth of about 2 feet to La Center and 1 foot to Woodland when improvement was commenced in 1898.

The first project (see Annual Report of the Chief of Engineers for 1897, p, 3475) provided for removing snags, some dike and dam work, and dredging to facilitate low-water navigation to La Center, at an estimated cost of $20,460. The acts of June 13, 1902, and March 2, 1907, extended the improvement up the North Fork. The work under this project has been the deepening of the channel by dredging and the removal of snags, stumps, and logs as far as La Center and Woodland.

During the year the snag boat *Mathloma* was employed in clearing the channel of the North Fork as far as Hayes Bend, 12½ miles from the mouth, of obstructing logs and snags. The most serious obstruction of the year was the formation of a bar in the draw span of the Northern Pacific bridge, about which much complaint was made, owing to the fact that the railroad company was very slow in doing the necessary dredging.

The project is completed except as pertains to maintenance. No increase in depth has resulted from the work done in the past year, the conditions being such that light-draft boats were operated throughout the year. The maximum draft that could be carried over the shoalest portion at the close of the year is believed to be as previously reported, viz, on the main river about 4 feet, and on the two forks to the head of navigation about 1 foot.

The available balance will be used in snagging, if required, this coming season, and the appropriation recommended will be applied to snagging and dredging for maintenance of improvement.

The river is the only means of transporting the products of the valley to the Portland market except at the town of Woodland, where the Northern Pacific Railway crosses the river, and the resulting competition has a beneficial effect on freight rates on all shipments from that point. The commerce consists principally of lumber and farm products and general supplies. During the calendar year 1907 the commerce amounted to 20,140 tons, not including large quantities of logs floated down the stream. The estimated value is approximately $1,179,117.

The amount expended on this work up to the close of the fiscal year 1908 was $19,559.58.

References to former reports are given on pages 690–691 of the Annual Report of the Chief of Engineers for 1905.

Comparative statement of traffic.

Calendar year.	Tons.	Estimated value.	Passengers.
			Number.
1898	6,303		15,938
1899	6,549		12,351
1900	12,638		14,129
1901	17,277		15,532
1902	13,831		13,098
1903	29,033		13,058
1904	27,245	$834,492	12,885
1905	26,554	1,067,733	29,026
1906	19,024	960,120	16,614
1907	20,140	1,179,117	13,869

This statement does not include 10,439,424 feet B. M. (17,399 tons) of logs sent down this stream in 1907, having an estimated value of $52,197.

July 1, 1907, balance unexpended	$4,574.93
June 30, 1908, amount expended during fiscal year for maintenance of improvement	1,284.51
July 1, 1908, balance unexpended	3,290.42
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	(a)

CONSOLIDATED.

July 1, 1907, balance unexpended	$17,466.68
June 30, 1908, amount expended during fiscal year for maintenance of improvement	12,754.59
July 1, 1908, balance unexpended	4,712.09
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	7,500.00

(See Appendix W W 6.)

7. *Grays River, Washington.*—Grays River is a tributary of the Columbia River, emptying into Grays Bay nearly opposite Astoria, Oreg. A small boat of 75 tons burden carrying freight and passengers makes daily trips between Astoria and a point 8 miles up the tidal portion of the river. The principal navigation is towing logs. At the mouth of the river the range in tide is 5 to 8 feet and the available depth at low water 3 feet.

The river and harbor act of March 2, 1907, appropriated $2,500 for the purpose of removing logs, snags, and stumps from the channel and overhanging trees from the banks, and the snag boat *Mathloma* worked there in December, removing the worst obstructions, though retarded in her operations by several freshets. The available balance will be expended by sending in a small party with skiffs and blasting appliances to blast out and demolish such logs and stumps as may still be in the way of steamboat navigation.

July 1, 1907, balance unexpended	$2,500.00
June 30, 1908, amount expended during fiscal year for works of improvement	1,113.30
July 1, 1908, balance unexpended	1,386.70

(See *Appendix W W 7.*)

[a] *See consolidated money statement on this page.*

8. Gauging waters of Columbia River, Oregon.—The object of this gauging is to obtain data for use in connection with the improvement of the river and to supply information to persons interested in its navigation.

The self-registering gauge was established at Astoria in November, 1888, where it was kept in operation up to August, 1899, and then moved to Fort Stevens, where it could be more economically maintained. Daily bulletins have been exhibited for the benefit of shipping interests. A river gauge was also established at the mouth of the Willamette River and daily records of the readings kept. In view of the benefit to commerce, the maintenance of these gauges is considered a worthy object.

The amount expended on this work up to June 30, 1908, was $8,529.94.

July 1, 1907, balance unexpended	$1,613.40
June 30, 1908, amount expended during fiscal year for maintenance of improvement	143.34
July 1, 1908, balance unexpended	1,470.06
July 1, 1908, outstanding liabilities	10.00
July 1, 1908, balance available	1,460.06
Amount that can be profitably expended in fiscal year ending June 30, 1910, in addition to the balance unexpended July 1, 1908	1,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix W W 8.)

EXAMINATION AND SURVEY REQUIRED BY THE RIVER AND HARBOR ACT OF MARCH 2, 1907.

The local officer was also charged with the duty of making a preliminary examination and survey of *Cowlitz River up to Castlerock, Wash.*, provided for in the river and harbor act of March 2, 1907, and report thereon will be duly submitted when received.

IMPROVEMENT OF RIVERS AND HARBORS IN THE SEATTLE, WASHINGTON, DISTRICT.

This district was in the charge of Maj. H. M. Chittenden, Corps of Engineers. Division engineer, Lieut. Col. S. W. Roessler, Corps of Engineers.

1. Willapa River and Harbor, Washington.—Willapa Harbor connects with the Pacific Ocean in the extreme southwestern part of the State of Washington. Willapa River flows into the bay at its eastern extremity, about 10 miles from the sea entrance to the harbor.

South Bend, near the mouth of the river, the terminus of a branch line of the Northern Pacific, and Raymond, about 3 miles above South Bend, are the principal towns in that locality. Willapa is a small town 10 miles above South Bend. North River is a stream flowing into the bay from the north, and Nasel River is an arm making off from the southeast part of the bay proper.

Originally shoals existed in the river below Willapa, and there was a log jam in North River.

The original project adopted by act of July 13, 1892, contemplated dredging 100 feet wide to a depth of 8 feet at low water through the reef just below Willapa and the closing of side sloughs near South Bend by means of dikes, with the object of increasing channel depths

by scour. This project was modified by act of March 2, 1907, which provided for dredging a channel 150 feet wide and 12 feet deep at mean lower low water through the shoals between South Bend and Raymond, at an estimated cost of $25,000.

Under acts of August 18, 1894, and March 3, 1899, removal of the log jam in North River was authorized.

The amount expended on original and existing project to close of fiscal year ending June 30, 1908, was $60,838.64, of which $4,040.20 was applied to the maintenance of dikes and for inspection of obstructions to navigation.

The dredging work authorized by act of March 2, 1907, was commenced November 15, 1907, and completed February 29, 1908. The work was done by contract.

The appropriation recommended will be applied to maintenance of existing channels and dikes.

The best channel depth at low water is now about 16 feet to South Bend, and to Raymond and Willapa about 12 feet.

The extreme variation of water levels is 14 feet, and the mean variation is 9 feet.

The North and Nasel rivers are navigable only for small boats of light draft for a comparatively short distance above their mouths, and this distance is extremely variable with the tides. The principal business on these rivers is the rafting and floating of logs. The log and lumber business on Willapa Bay and tributary streams is by far the most important part of the water traffic.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	32,899	$374,050	1903	74,475	$446,800
1899	51,150	755,682	1904	73,808	389,377
1900	42,090	266,080	1905	76,713	456,213
1901	39,538	229,686	1906	116,717	1,220,434
1902	51,999	402,050	1907	183,801	1,847,810

The direct effect on freight rates of the work done is not known definitely.

Reference to reports, etc., may be found in the Annual Report of the Chief of Engineers for 1907, page 781.

The full amount for improvement as heretofore authorized by Congress has been appropriated.

July 1, 1907, balance unexpended	$25,179.44
June 30, 1908, received from sales	.50
	25,179.94
June 30, 1908, amount expended during fiscal year for works of improvement	24,668.08
July 1, 1908, balance unexpended	511.86
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	5,000.00

(See Appendix X X 1.)

2. Grays Harbor and bar entrance, Washington.—Grays Harbor *is a large bay in the* southwestern part of the State of Washington.

connecting with the Pacific Ocean. It has a total length from east to west of 17 miles, and its greatest breadth north and south is 14 miles.

A large part of the bay is occupied by tide flats, bare at low water. At low tide the area covered by water is estimated at 30.6 square miles, or less than one-third of the total area.

A short distance within the harbor entrance are large areas affording anchorage for deep-draft vessels.

The harbor entrance is between two low sandy peninsulas, which are about 12,500 feet apart, measured between high-tide lines.

Through this entrance there is a channel having a maximum depth of 100 feet or more. A single broad waterway extends for more than 2 miles out to sea from the entrance, with depths gradually diminishing to 30 feet. At the outer end of this deep waterway lies a bar convex to the sea and extending each way to the sand spits on the two sides of the harbor throat.

Across the bar there was originally no good permanent channel, but there were several variable, shifting channels having depths of about 12 or 13 feet. The general average width of the bar between the inner and outer 18-foot curves was one-half mile.

The original project, adopted by Congress June 3, 1896, provided for the control of tidal currents by means of a single jetty extending out to sea from the point on the south side of the harbor throat a distance of about 3½ miles, with a view to improving and maintaining the channel over the bar by scour. The jetty was to be of rubblestone, built above high-tide level. This project contemplated a depth of 24 feet at mean low water.

The estimated cost was $1,000,000. The act making the first appropriation for this work authorized the making of a continuing contract or contracts. In accordance with this authority a contract for the entire work was entered into after due advertisement. This contract was approved by the Chief of Engineers February 23, 1898. Work under it commenced in March, 1898, and terminated September 15, 1902. No construction work on the south jetty has been done since.

The project was enlarged by the river and harbor act of March 2, 1907, which provided for the construction of a jetty on the north side of the harbor throat, extending out to sea 9,000 feet from the ocean high-water line, at an estimated cost of $600,000. The act appropriated $200,000 and authorized continuing contracts for completing the project in the additional sum of $400,000, of which amount there remains $100,000 to be appropriated.

The amount expended to June 30, 1908, was $1,099,081.99, of which $6,235.72 was for maintenance and surveys.

The work on the north jetty has been in progress for about nine months. The necessary land for approach and operating plant was donated to the United States by local interests. The trestle approach to the jetty and the wharf and other features of the shore works were built under contract, the work commencing on October 24, 1907, and being completed March 31, 1908. A contract has been made for the stone for the jetty, the other material being furnished under emergency contracts or purchase in open market. At the close of the fiscal year the jetty had progressed 2,624 feet from high-water line. Progress has been delayed by the failure of the contractors to furnish stone as fast as required.

The work of maintenance consisted only in care of the property.

The appropriation recommended will be applied to continuing construction of the north jetty.

The bar channel has shown variations in depth and position during the year. The maximum draft that could be carried June 30, 1907, at mean low water over the shoalest part of the channel was about 24 feet.

The extreme variation of water levels in the outer portion of the harbor is 16.5 feet, while the mean variation is 8.4 feet.

The commerce benefited by the work consists at present principally of exportation of lumber, carried in sail vessels and steam schooners. This is a large and important business.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	168,468	$1,252,089	1903	458,268	$4,073,333
1899	265,918	1,979,998	1904	495,495	4,200,784
1900	259,692	2,077,037	1905	579,759	5,552,166
1901	299,607	1,877,800	1906	614,854	7,735,954
1902	527,047	3,601,163	1907	747,725	8,862,687

The direct effect on freight rates of the work done is not known.

Reference to reports and projects are given on pages 782 and 783 of the Annual Report of the Chief of Engineers for 1907.

July 1, 1907, balance unexpended	$223,224.36
Amount appropriated by sundry civil act approved May 27, 1908	300,000.00
	523,224.36
June 30, 1908, amount expended during fiscal year for works of improvement	92,302.75
July 1, 1908, balance unexpended	430,921.61
July 1, 1908, outstanding liabilities	16,529.21
July 1, 1908, balance available	414,392.40
July 1, 1908, amount covered by uncompleted contracts	414,056.75
Amount (estimated) required for completion of existing project	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897.	100,000.00

(See Appendix X X 2.)

3. Grays Harbor (inner portion) between Aberdeen and the entrance to said harbor, and Chehalis River, Washington.—There are two main channels traversing the inner or eastern part of Grays Harbor from east to west—the North and South channels. There was also formerly a Middle channel connecting the North and South channels. The South channel is shoal and is but little used. The North channel is used by all ocean-going vessels entering the harbor. There are two shoals in the North channel, one about 2½ miles below Hoquiam and one between Hoquiam and Aberdeen. The ruling depth over these shoals was originally 8 feet at mean low water. The channel widths were ample.

The Chehalis River is in the southwestern part of Washington. It has a westerly course and empties into Grays Harbor Bay at its eastern extremity.

From the mouth to Montesano, 15 miles, there is about 10 feet of water at high tide. From Montesano to Elma, 16 miles, there is generally sufficient water for light-draft boats. There is practically no navigation above Elma and no regular boats go above Montesano. The river is used extensively for floating saw logs.

The original project for the inner harbor, adopted by Congress July 13, 1892, provided for the construction of pile, brush, and stone dikes to partly close up the South and Middle channels and concentrate the flow of water in the North channel, thereby increasing the depth of water by scour. The shoals above and below Hoquiam were to be dredged to a depth of 16 feet at half tide.

The amount expended prior to operations under existing project was $93,999.06.

The original project for Chehalis River, adopted by Congress August 2, 1882, contemplated the removal of snags and other obstructions which may accumulate in the portion of the river regularly used by boats. The estimated cost is indefinite.

The existing project adopted by the river and harbor act of March 2, 1907, provides for a channel 200 feet wide and 18 feet deep at mean lower low water from Cosmopolis to deep water below Hoquiam. and removing snags from the Chehalis River, at an estimated cost of $187,500, increased in this report to $262,500. This plan is printed in House Document No. 507, Fifty-ninth Congress, first session.

To June 30, 1908, $164,596.21 has been expended under the above project for Grays Harbor, inner portion, of which $19,997.21 was applied to maintenance of dikes and for surveys.

Two middle dikes and a protecting sill, with an aggregate length of 13,986 feet, had been constructed in the inner harbor, and six high-tide dikes, with an aggregate length of 1,476 feet, had been constructed in the Chehalis River. The depth of water over the shoals in the inner harbor was increased about 2 feet and over the shoals in the Chehalis River from 2½ to 7 feet, but these depths were not permanent.

The dredging work under the existing project is being done by contract. It was commenced December 16, 1907, and is still in progress, the total quantity of material removed during the fiscal year being 900,000 cubic yards.

Snagging operations were carried on in the Chehalis River during July, 1907.

The appropriation recommended will be applied toward procuring a channel of full cross section for its entire length as contemplated by the project and in maintenance of existing channels and dikes.

The maximum draft that could be carried June 30, 1907, over the shoals below Aberdeen at low water was about 18 feet.

The maximum draft that could be carried June 30, 1907, at mean low water at Montesano was about 5½ feet.

The tidal variation is 8½ feet in the inner harbor and 7 feet in the Chehalis River.

The commerce benefited by this improvement consists very largely of floating and towing logs and carrying lumber in sailing vessels and steam schooners.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	2,730	$293,610	1903	4,972	$139,150
1899	2,232	352,316	1904	5,637	248,825
1900	4,376	132,157	1905	17,195	650,428
1901	5,706	200,264	1906	11,567	773,574
1902	3,529	157,582	1907	9,414	687,703

No definite information of reduction of freight rates on account of the improvement has been received.

Reference to reports, projects, etc., may be found on page 785 of the Annual Report of the Chief of Engineers for 1907.

July 1, 1907, balance unexpended	$200,450.17
June 30, 1908, amount expended during fiscal year for works of improvement	108,045.44
July 1, 1908, balance unexpended	92,404.73
July 1, 1908, outstanding liabilities	387.50
July 1, 1908, balance available	92,017.23
July 1, 1908, amount covered by uncompleted contracts	86,526.73
Amount (estimated) required for completion of existing project	[a]75,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	81,000.00

(See Appendix X X 3.)

4. Puget Sound and its tributary waters, Washington.—Most of the channels of Puget Sound proper have ample depths for purposes of navigation, but the extensive lumber and fishing industries in these waters render it very important to maintain a general supervision over the navigable channels, to regulate the construction of fish traps, log booms, and other structures incident to these important industries, and to prevent obstructions which are detrimental to general navigation. A number of streams and rivers tributary to Puget Sound are of great value to boat navigation, but they are all liable to be obstructed by the débris generally found in streams flowing through a heavily wooded country.

All these streams are used to a greater or less extent for floating logs and shingle bolts, and the towing of log rafts and timber products constitutes the main part of the commerce. The distance upstream to which boats run is extremely variable, depending on the stage of water and tide. Steamboat navigation on the Skagit extends as far up as the mouth of the Sauk, but boats do not often ascend above Hamilton or Birdsview. No survey has been authorized by Congress above Sedro Woolley, 25 miles above the mouth of the river. On the Stilaguamish boats do not go above Florence, 6 miles from the mouth. The Snohomish is navigable for river boats to the Forks, 22 miles,

[a] The project calls for a channel 200 feet wide. With the funds appropriated by act of March 2, 1907, a channel of the proposed width could not be obtained on account of the excess in cost per cubic yard over the estimated cost.

and the lower portions of its tributaries, the Snoqualmie and Skykomish, are navigable at high stages. On the Duwamish small boats go as far as the junction of the White and Black rivers, about 16 miles from the mouth. Under favorable conditions they can go several miles up the White, and occasionally boats pass up the Black into Lake Washington. On all these streams the distances to which steamboat navigation actually extends are generally less, and the distances over which towing and floating of logs extend are greater than the distances above named. None of these streams is closed in winter by ice. All are affected by the tidal variation in Puget Sound, which is large and extremely irregular.

The work of improvement consists in the maintenance of the navigable channels by snagging and removing obstructions.

Formerly works of improvement were carried on under specific appropriations, but since the act of June 13, 1902, appropriations have been made in the present general and comprehensive form, except in cases of large local works. This method operates greatly to the advantage and economy of the work.

The amount expended to June 30, 1908, was $316,225.85.

The act of March 2, 1907, provided for the removal of the rock in the entrance to Roche Harbor at a cost not to exceed $30,000. The work was begun October 1, 1907, under contract, and completed April 17, 1908.

The water traffic on Puget Sound and its tributary waters is very large and rapidly growing. It includes vessels of about every type and size in use throughout the world, but it is quite impracticable to give in the form of concise statistics a condensed statement of the amount and value of the commerce more or less directly benefited by work under this appropriation. Statistics have been compiled only for the tributary streams on which the snag boat has mostly worked.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	12,676	$539,406	1903	94,274	$3,193,458
1899	13,500	577,586	1904	92,465	1,799,823
1900	35,066	1,324,926	1905	86,412	1,817,048
1901	30,155	1,499,420	1906	167,197	1,898,657
1902	61,794	2,324,980	1907	121,336	3,011,146

No definite information relative to effect of the work on freight rates is available, but the increasing number of vessels engaged indicates greater competition.

Reports of examinations and surveys of the rivers of Puget Sound are referred to in Annual Report of the Chief of Engineers for 1904, page 692.

Reference to reports on the examination and survey of the Duwamish River authorized by the river and harbor act of March 3, 1905, will be found on page 787 of the Annual Report of the Chief of Engineers for 1906.

The snag boat operated extensively in all parts of the Sound, doing a large amount of work. Between the dates July 1 and 31 it was hauled out for repairs. The hull was strengthened and the machinery overhauled and put in good condition.

The snag boat is no longer capable of serving the needs of the district. It was built in 1882, the hull renewed in 1896, and it is now in a condition that practically requires another renewal. It is not sufficiently seaworthy to be safe in ordinary rough weather in the Sound. A new plant is required, and it is proposed to provide a combined snag boat and small suction dredge to do such work as is not of sufficient magnitude to be undertaken by contract.

There is a considerable amount of miscellaneous work in the district that is paid from this appropriation, such as investigation of harbor lines, bridges, obstructions, occasional surveys, gauge readings, etc.

GENERAL IMPROVEMENT.

July 1, 1907, balance unexpended	$73,438.93
July 1, 1907, received from sales	3.00
	73,441.93
June 30, 1908, amount expended during fiscal year for works of improvement	49,504.63
July 1, 1908, balance unexpended	23,937.30
July 1, 1908, outstanding liabilities	4,425.63
July 1, 1908, balance available	19,511.67
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908	130,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

EMERGENCIES IN RIVERS AND HARBORS.

July 1, 1907, balance unexpended	$366.82
June 30, 1908, amount expended during fiscal year for maintenance	366.82

(See Appendix X X 4.)

5. *Inspection of fish traps, etc., Puget Sound, Washington.*—The fishing industry on Puget Sound has rapidly developed during the past few years, and it has now reached very large proportions. Until four years ago the fish traps were placed with little or no regard to the established aids to navigation or to the laws relative to structures in navigable waters, but during the year 1904 the fishing companies were brought to the adoption of a different policy. Since 1894 this work has been done under allotments from the appropriation for "Examinations, Surveys, and Contingencies of Rivers and Harbors." Under these allotments a tug was hired for the inspection of fish traps from time to time as necessary. A tug was so engaged for two months during the year.

As a general rule all the fish-trap owners and fishing companies now readily conform to the requirements that have been imposed for the safety of navigation, and the Federal supervision of the traps in the interests of navigation is recognized locally as most necessary and beneficial to the public interests.

The total amount expended to June 30, 1908, was $28,124.42, of which $10,369.52 was expended during the year.

Form of permit and rules relative to lights and fog signals were published in the Annual Report of the Chief of Engineers for 1905, *pages 2558–2560.*

To carry out more effectively and economically the inspection of fish traps and other obstructions to navigation an inspection boat has been constructed for exclusive use in this work. The boat is 63 feet long, 11 feet 6 inches breadth of beam, and has a draft of 4 feet, and is propelled by a 50-horsepower gasoline engine.

(See Appendix X X 5.)

6. Harbor of Olympia, Wash.—Olympia is situated at the extreme southern point of Puget Sound at the head of Budd Inlet. The upper end of this inlet is shoal. Shoal water extends northward from the Fourth Street Bridge for a distance of 8,750 feet to a depth of 12 feet at mean lower low water in Budd Inlet. Originally nothing but shallow-draft boats could reach the wharves near Fourth Street Bridge, and those only at high tide.

The original and existing project, adopted by Congress by act of July 13, 1892, contemplates dredging a channel 250 feet wide and 12 feet deep at the mean of the lower low waters from the vicinity of the Fourth Street Bridge to deep water in Budd Inlet.

Near its inner end the channel has been widened to 500 feet, so as to provide a turning basin for boats using it. The estimated cost is $147,000.

The amount expended to June 30, 1908, was $139,880.53, of which $1,001.30 was for maintenance.

The dredging of the channel and basin was completed in accordance with the project, under contract. The maximum draft that could be carried through the channel and basin on June 30, 1907, at low water was 12 feet. The tidal variation is about 20 feet.

The commerce of the harbor is of general character and is carried on by ocean-going sailing vessels engaged in the lumber trade and by a variety of the smaller classes of boats plying between the ports of Puget Sound. Sufficient depth for seagoing vessels has not yet been secured in the dredged channel and basin, though vessels of the deepest draft can go as far as the entrance of the dredged channel, and sailing vessels carrying lumber now reach wharves near the entrance to the dredged channel at high tide and lie in a dredged basin while loading.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	52,335	$1,203,226	1903	40,338	$841,635
1899	42,694	1,173,684	1904	20,152	356,450
1900	35,466	848,703	1905	62,804	2,069,289
1901	44,569	951,435	1906	82,024	2,363,433
1902 *a*	.....	.....	1907	95,171	2,846,955

[a] Not obtainable.

No definite information as to the effect on freight rates of the work done is available.

Description and map are published in Annual Report of the Chief of Engineers for 1900, pages 4481 to 4483.

Reports on examination and survey of Olympia Harbor are referred to in Annual Report of the Chief of Engineers for 1904, page 694.

Reference to reports on examination and survey authorized by the river and harbor act of March 3, 1905, will be found on page 787 of the Annual Report of the Chief of Engineers for 1906.

The full amount for this improvement as heretofore authorized by Congress has been appropriated.

July 1, 1907, balance unexpended	$7,277.43
June 30, 1908, amount expended during fiscal year for maintenance of improvement	157.96
July 1, 1908, balance unexpended	7,119.47

(See Appendix X X 6.)

7. *Tacoma Harbor, Washington.*—At the southern end of the harbor are extensive tide flats which are bare at low water. Outside of these tide flats the depth increases very rapidly up to depths of 200 feet or more, reaching depths as great as 600 feet at the mouth of the bay, about 3 miles distant from the low-water line at its southern end. The principal water front of Tacoma is along the southwestern shore of the bay. Harbor lines have been established around the south end of the bay and along its western side. In order to facilitate commerce several waterways extending into the flats or tidelands have been laid out. One of these is known as the City or West waterway. The harbor of Tacoma may be considered to embrace all of Commencement Bay, including the waterways mentioned.

The extreme tidal variation is some 18 feet; mean variation, 14.5 feet.

The original and existing project for improvement of the City waterway, adopted by Congress by the act of June 13, 1902, contemplates dredging in the City waterway from deep water in Commencement Bay to Eleventh street to a depth of 25 feet, from Eleventh street to Fourteenth street to a depth of 18 feet, and from Fourteenth street to the south end of waterway to a depth of 15 feet at extreme low water. The dredging was done under a continuing contract.

The amount expended to June 30, 1908, was $164,927.91, of which $11,415.37 was for maintenance, inspections, and surveys.

The City waterway has been completed according to the project, and the prescribed depths could therefore be carried for the whole length and width of the waterway on June 30, 1906.

The act of March 3, 1905, provided for improvement of the Puyallup waterway by dredging a channel 500 feet in width and 3,650 feet in length from its northern end, and to a depth of 28 feet at extreme low water, in accordance with the report submitted in House Document No. 520, Fifty-eighth Congress, second session, at an estimated cost of $240,000. The same act appropriated $40,000, and authorized continuing contracts for completing the project in the sum of $200,000, of which $40,000 is yet to be appropriated. The act requires that certain portions of the necessary work shall be done without expense to the United States, and that provision for permanent maintenance of the project without expense to the Government shall be made.

The conditions named in the said act have been complied with, and a contract was let for the work October 3, 1907, and is now in progress.

The appropriation recommended will be applied toward improvement of Puyallup waterway, as provided for in the act of March 3, 1905.

The commerce to be benefited by this improvement is of a large and extremely varied character, including that carried on by Sound and

river types of boats, as well as that of the largest steam and sailing vessels. A very important item is the export of grain, in which the port of Tacoma exceeds all other ports on Puget Sound.

Exports and imports.

Calendar year.	Tons.	Value.
1903	1,715,085	$58,153,845
1904	1,561,074	58,726,772
1905	1,844,338	65,613,183
1906	1,120,070	48,253,383
1907	1,570,396	54,168,018

No definite information is available as to the effect of the improvement on freight rates.

Work was begun under the contract December 26, 1907, but as the contractors had to build their plant, and have only just completed it, no dredging of consequence has been done. Considerable progress has been made on the bulkhead work.

July 1, 1907, balance unexpended		$216,811.91
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$3,358.46	
For maintenance of improvement	3,381.36	
		6,739.82
July 1, 1908, balance unexpended		210,072.09
July 1, 1908, outstanding liabilities		599.50
July 1, 1908, balance available		209,472.59
July 1, 1908, amount covered by uncompleted contracts		192,000.00
Amount (estimated) required for completion of existing project		40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908 — Submitted in compliance with requirements of sundry civil act of June 4, 1897.		40,000.00

(See Appendix X X 7.)

8. Waterway connecting Puget Sound with Lakes Union and Washington, Washington.—Lakes Union and Washington are bodies of fresh water near Puget Sound, in the immediate vicinity of the city of Seattle. Lake Union is entirely within the city limits. The proposed improvement originally contemplated a ship canal connecting both lakes with the sound. There is no navigable connection at present.

A succinct history of the project and references to reports, etc., may be found on pages 791 to 793 of the Annual Report of the Chief of Engineers for 1907.

The only actual work done on the proposed waterway has consisted of dredging a channel from the sound to the wharves at Ballard, in Salmon Bay. The work was done under the river and harbor acts of June 3, 1896, and March 3, 1905. It has resulted in a channel 50 feet wide and 16 feet deep at low water, from Puget Sound to a point 2,000 feet west of the lock site. From this point to the lock site the channel is 75 feet wide and 16 feet deep. From the lock site to the railroad trestles at the eastern part of Ballard Harbor

the channel is 75 feet wide and 10 feet deep at low water. A turning basin ranging from 175 feet to 500 feet in width has been dredged at Ballard.

The amount expended to June 30, 1907, was $468,966.27. Of this amount $21,886.43 was expended in maintenance and on improvement of drainage of Lake Washington.

The present commerce benefited by the improvement of the channel to Ballard is the towing of logs to the mills at Ballard and the export of lumber and shingles from that place. Logs are brought in in rafts and lumber is loaded on sailing vessels and scows at the mills and then towed to the open sound.

It has not been practicable to determine what effect the improvement work has had upon freight rates.

The maximum draft that could be carried to the wharves at Ballard, June 30, 1907, was 10 feet at low water. The maximum tidal variation is about 18 feet.

The appropriation recommended will be applied to maintenance of existing outlets between Lake Washington and Puget Sound, care and preservation of right of way, and for contingencies.

Early in 1906 a movement was started for the construction of the canal with local funds and to this end secured the passage of an act of Congress, approved June 11, 1906, authorizing James A. Moore or his assigns to construct a canal along the Government right of way connecting the waters of Puget Sound with Lake Washington. This act was modified by the act of March 2, 1907, so as to permit Mr. Moore, or his assigns, to commute the work required under the previous act to excavation alone of a canal from deep water in Puget Sound to deep water in Lake Washington with a bottom width of 75 feet and a depth at mean low water of 25 feet. The same act directed a survey and estimate of cost of a canal with a single lock and a report as to what contribution, if any, local interests would make toward its construction.

To assist the United States through the agency of the Moore acts in building a canal, the county of King voted a bond issue of $500,000 on September 12, 1906. These bonds were declared invalid by the supreme court of the State. An attempt was made by the legislature to remedy the defects, but its efforts were not upheld by the supreme court, and further legislation will be necessary at the next session.

On March 13, 1907, the State legislature passed an act creating a local assessment district, embracing territory that would be benefited by the canal, and empowering the district to raise by taxation a sum not exceeding 1 per cent of the taxable valuation of the county, and to use the money so received to aid in constructing the canal. The board of appraisement was to be appointed by the local United States district judge, and the money is to be expended under the direction of the United States engineer officer in charge of the local engineer district. Under this act the district has been duly formed by the necessary action of the county commissioners, the board of appraisement has been appointed and has entered upon its duties, and the work of making the assessment is completed. The assessment has now to be considered by the county commissioners sitting as a board of equalization, after which it is subject to collection, either in cash or in issue of bonds. The sum to be raised is $1,075,000, which is intended to yield, after the cost of assessment and collection and other

incidental expenses are paid, the sum of $1,000,000 in aid of the canal. The total local contribution now in view is, therefore, $1,500,000.

Reference to report on survey required by the river and harbor act of March 2, 1907, will be found on page 850 of this report.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1901	410,565	$2,002,950	1905	888,161	$4,588,198
1902	428,073	2,432,401	1906	705,841	3,993,410
1903	524,500	2,219,000	1907	797,228	5,520,518
1904	584,079	2,520,785			

NOTE.—The above includes only the present commerce of Ballard and Salmon Bay, Lake Union, and Lake Washington.

The loading of vessels with lumber has been largely facilitated by the work done in Ballard Harbor. Formerly the lumber was taken out by means of lighters to the vessels anchored in the Sound. Now all but the largest vessels are brought to the mills to receive their loads.

July 1, 1907, balance unexpended		$9,030.88
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$5,000.00	
For maintenance of improvement	2,997.15	
		7,997.15
July 1, 1908, balance unexpended		1,033.73
July 1, 1908, outstanding liabilities		104.00
July 1, 1908, balance available		929.73
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908		10,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix X X 8.)

9. Everett Harbor, Washington.—At this harbor the southern part of the water front has ample depth and is accessible for vessels of the deepest draft. The northern portion was inaccessible on account of the delta formation or tide flats off the mouth of the Snohomish River and the whole water front was exposed to westerly storms.

The original project was as follows:

First, to excavate a harbor basin in the shallows and tidelands adjoining deep water near the river's mouth; second, to dredge a channel from this through the tide flats and the Old River mouth to deep fresh water in the Snohomish River, this channel being designed to bring fresh water to the harbor basin and to afford facilities for navigation about the peninsula and into the deep water of the river bounding the peninsula on the east; and third, to protect and maintain this harbor and channel across the tide flats by a bulkhead interposed between them and the open waters of the Sound, the bulkhead to act as a retaining wall for the material dredged from the harbor.

By authority of joint resolution of Congress approved April 23, 1902, the work in Old River was discontinued, the project for a fresh-water basin was abandoned, and the further expenditure of the funds

has been for deepening and widening the harbor basin and channel through the tide flats and repairing the bulkheads.

The estimated cost of the improvements was $422,000, all of which has been appropriated.

The amount expended on project to June 30, 1908, was $417,577.77, of which $2,867.73 was for maintenance and $3,000.90 for purchase of quarry at Goat Island.

A dike for the purpose of retaining the dredged material has been built from the lower end of Smiths Island along the established bulkhead line for a distance of 19,336 feet. At the southern end of this work an outside bulkhead 200 feet from the other has been built for a distance of 2,600 feet. These dikes have been repaired, raised, and strengthened. The channel leading north from the basin had been dredged to a depth of 6 feet at low water for a distance of 6,000 feet. A channel in the Old River had been partly dredged for a distance of 11,600 feet downstream before this part of the work was discontinued under the resolution of Congress above referred to.

The harbor basin has been dredged for a length of 5,500 feet and for a width of 400 feet and depth of 26 feet at mean low water.

No work was in progress during the year, the expenditure being for the purchase of a quarry and contingencies.

The maximum draft that could be carried through the dredged area June 30, 1906, at low water was 26 feet. The tidal variation is approximately 15 feet.

The water traffic is varied in character and is carried on by seagoing vessels and the various types of Sound and river boats. Lumber products, paper, and flour are the principal items of the export trade.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	55,460	$2,545,054	1903	79,394	$2,510,417
1899	42,713	1,477,120	1904	163,347	3,342,215
1900	55,094	1,820,561	1905	230,089	4,592,124
1901	71,881	2,712,260	1906	159,203	3,820,860
1902	85,263	4,024,584	1907	143,710	4,725,700

The effect of the completed dike as a breakwater and protection for the wharves and mills abreast of it has been very beneficial, but the channel and harbor basin dredged have not yet been utilized for commercial purposes.

Reference to reports, etc., may be found on page 795 of the Annual Report of the Chief of Engineers for 1907.

July 1, 1907, balance unexpended		$7,745.37
June 30, 1908, amount expended during fiscal year:		
For works of improvement	$3,000.90	
For maintenance of improvement	322.24	
		3,323.14
July 1, 1908, balance unexpended		4,422.23

(See Appendix X X 9.)

10. Swinomish Slough, Washington.—This slough affords an inland sheltered passage for small vessels from Puget Sound proper northward to Bellingham Bay and the Gulf of Georgia, and it is the *only means of communication* to the town of La Conner, located on

the slough. At the northern end the slough opens out through the mud flats of Padilla Bay and on the south into Saratoga Passage through the mud flats forming the delta of the Skagit River. The total distance from deep water in Saratoga Passage to deep water in Padilla Bay is about 11 miles. This waterway is of great importance to traffic between Puget Sound and points north in giving an inside passage for small craft in rough weather, and an outlet for the agricultural and timber products from the surrounding country.

The original and present project, adopted by Congress by act of July 13, 1892, contemplates dredging a channel 4 feet deep and 100 feet wide from deep water in Saratoga Passage across Skagit flats, through the shoals of the slough proper and across the flats of Padilla Bay to deep water, and building dikes in Skagit Bay to control the tidal currents.

The entire work done under this project was not entirely successful owing to insufficient knowledge of the conditions and the character of the work required to meet them. The work of the last few years has been of a more substantial character and has produced excellent results.

The amount expended to June 30, 1908, was $203,612.15, of which $31,233.45 was for maintenance.

The dike work completed to date between La Conner and Saratoga Passage is as follows: Pile, brush, and stone dike on the north side of the channel from "Hole in the Wall" to opposite the west end of Goat Island, 7,100 linear feet; on the south side of the channel from the west end of Goat Island to deep water in Saratoga Passage 3,650 linear feet; and from McGlinns Island to the mainland in the direction of La Conner, 3,500 feet.

The dredging accomplished during the past year amounts to 480,000 cubic yards at an average cost of 10 cents per yard. The principal work of this character consisted in cutting out several bad bends in the main slough near the railroad and county bridges. Considerable work was also done at the shoal just south of La Conner, and at the outer end of the channel near Goat Island.

The quantity of work accomplished with the last appropriation, $75,000, act of March 2, 1907, has been considerably more than planned, both in dredging and in dike work; but owing to certain modification of plans, the necessity for which developed during the progress of the work, the desired work in Padilla Bay and the removal of certain rock points at "Hole in the Wall" will have to be deferred for the present.

The work accomplished this season has greatly facilitated navigation to La Conner and through the slough, but it is not known what effect, if any, it has yet had on freight rates.

The appropriation recommended will be applied to maintenance of existing channels and dikes.

A report on examination and survey of Swinomish Slough, upon which the plan of improvement is based, is referred to in Annual Report of the Chief of Engineers for 1904, page 699.

A map showing parts of the improvement is published in the Annual Report of the Chief of Engineers for 1900, opposite page 4488.

Map showing the work of the past season accompanies this report.

The average tidal variation is about 8 feet.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1898	19,625	$882,345	1903	51,399	$1,473,197
1899	76,636	2,028,454	1904	56,262	1,539,094
1900	74,516	1,611,460	1905	48,724	1,363,729
1901	126,747	2,991,330	1906	53,261	1,494,382
1902	49,914	1,472,847	1907	46,289	1,582,666

To obtain the full benefit of this improvement, as explained in Appendix X X 10, the district officer recommends a substantial extension of the existing project.

July 1, 1907, balance unexpended	$72,954.55
June 30, 1908, amount expended during fiscal year for works of improvement	71,566.70
July 1, 1908, balance unexpended	1,387.85
July 1, 1908, outstanding liabilities	1,387.85
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	10,000.00

(See Appendix X X 10.)

11. New Whatcom (Bellingham) Harbor, Washington.—The local name of the town at this place is now Bellingham.

The mud flats in the harbor extend from the shore line to the 12-foot curve, a distance of 3,400 feet.

A system of harbor lines for this harbor, approved by the Secretary of War under date of June 3, 1892, provides for three waterways leading from deep water to the meander line.

The original and existing project, adopted by Congress by the act of June 13, 1902, contemplates dredging the Whatcom Creek waterway to a depth of 12 feet at mean lower low water and 200 feet wide from deep water as far as the railroad bridge, and to its full width inside this bridge. The estimated cost is $80,000.

The amount expended to June 30, 1908, was $57,673.98, of which $1,092.05 was for maintenance and inspections.

A channel 200 feet wide and 12 feet deep at low water, with turning basin at inner end, has been dredged under contract. The channel extends the full length of the waterway, and the basin at the inner end has full width of the waterway, 330 feet, and is 2,570 feet long.

During the year no work has been in progress.

The work contemplated by the project was completed at somewhat less than the estimated cost and a larger amount of dredging was done than was expected with the funds available.

The maximum draft that could be carried June 30, 1906, at low water over the full length of channel and turning basin was 12 feet. The range of tide is about 12 feet.

Exports and imports.

Calendar year.	Tons.	Value.
1902	87,118	$2,872,769
1903	101,989	1,835,486
1904	236,669	4,225,480
1905	254,240	4,690,935
1906	292,592	5,643,504
1907	319,613	7,209,796

The work has not yet produced any material effect on freight rates so far as known.

The commerce of this port is of a general nature, consisting largely of lumber, shingles, and fish. Vessels of the deepest draft can go as far as the entrance of the proposed dredged channel.

Description of proposed work is published in the Annual Report of the Chief of Engineers for 1897, pages 3478 to 3481.

Reports on examination and survey are referred to in the Annual Report of the Chief of Engineers for 1904, page 701.

July 1, 1907, balance unexpended	$2,326.02
July 1, 1908, balance unexpended	2,326.02

(See Appendix X X 11.)

12. Columbia River between Wenatchee and Bridgeport, Wash.—The Columbia River between Wenatchee and Bridgeport, Wash., is about 80 miles in length, has sufficient depth for all purposes of navigation, and the only difficulties in the way of navigation are the swift currents and rocks and reefs which occupy the channels.

The project adopted by the river and harbor act approved August 18, 1894, for the improvement of the Columbia River between the head of Rock Island Rapids and the foot of Foster Creek Rapids included the part of the river between Wenatchee and Bridgeport, and the amount expended on the original project was $8,005.20.

The existing project, adopted by act of March 2, 1907, contemplates the improvement of the river between Wenatchee and Bridgeport by the removal of rocks, bowlders, etc., and the construction of dikes and wing dams, at an estimated cost of $42,000.

The work of the year consisted exclusively in the removal of ledge rock and bowlders, a large portion of which is below low water. Owing to the great range of the river between high and low water and the short period during which it is at a stage low enough for practicable operations, it was not possible to take up more than one of the several works embraced in the project. This was at Methow Rapids, where rocks and reefs were removed to about 7 feet below low water at four points. The total quantity of material removed was 18,277 cubic yards. The navigability of the river at Methow Rapids has been noticeably improved, but the full benefits to be derived from the work done can not be known until after the high water of this year.

The amount expended to June 30, 1908, was $22,069.31, of which $150 was for maintenance and inspections.

The project is about 50 per cent completed.

The variation in water surface is about 20 feet.

Exports and imports.

Calendar year.	Tons.	Value.
1904	24,506	$2,251,590
1905	39,827	3,169,060
1906	53,260	3,901,360
1907	42,126	3,091,550

Report of a survey including this part of the Columbia River was published in Annual Report of the Chief of Engineers for 1895, pages 3534–3542.

Report on examination and survey of the part of the river between Wenatchee and Bridgeport was published in House Document No. 440, Fifty-ninth Congress, second session.

July 1, 1907, balance unexpended	$42,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	22,069.31
July 1, 1908, balance unexpended	19,930.69
July 1, 1908, outstanding liabilities	731.52
July 1, 1908, balance available	19,199.17

(See Appendix X X 12.)

13. Okanogan and Pend Oreille rivers, Washington.—(*a*) *Okanogan River.*—This river rises in Canadian territory, flows in a southerly direction, and empties into the Columbia. The lower portion, for a distance of 87 miles, lies in the northeastern part of Washington. The lower portion has sufficient depth and width for light-draft steamboat navigation throughout a good portion of the year, but it is obstructed in places by shoals and rocks, which interfere with navigation during low water.

The original and existing project, adopted by Congress by act of March 3, 1899, contemplates rock removal, the construction of wing dams, and snagging. By act of June 13, 1902, this work and that of the Pend Oreille were consolidated.

The estimated cost was $30,000 for the Okanogan. The amount expended to June 30, 1908, was $38,012.79, of which $6,048.45 was for maintenance.

Work of removing rocks and bowlders, wing-dam construction, and placing posts to assist vessels in hauling over rapids has been done at various points over about 40 miles of the lower portion of the river.

Cables to assist vessels in passing the rapids were placed at seven places on the Okanogan River.

During the year no work was done on the Okanogan River.

The extreme variation of water levels at the junction with the Columbia is 37 feet; extreme variation 6 miles above said junction, 20 feet.

The commerce of the river is carried on in small river steamers and consists of general traffic.

Exports and imports

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1899	1,738	$151,415	1904	1,636	$252,414
1900	(a)	(a)	1905	1,184	228,675
1901	983	.....	1906	1,960	253,880
1902	1,571	119,065	1907	2,040	400,100
1903	6,317	458,705			

[a] Not obtainable.

The freight rates on this river are believed to have been materially reduced since the work started, but no definite information is available.

Report on survey with description of the river and the plan of improvement are given in the Annual Report of the Chief of Engineers for 1898, page 3121.

Report on examination of Okanogan River is published in Annual Report of the Chief of Engineers for 1895, page 3475.

No additional work other than that of maintenance is contemplated on this stream.

July 1, 1907, balance unexpended		$4,056.79
June 30, 1908, amount expended during fiscal year:		
By transfer to Pend Oreille River to correct error	$2,000.00	
For maintenance of improvement	75.00	
		2,075.00
July 1, 1908, balance unexpended		1,981.79

(*b*) *Pend Oreille River.*—This river forms the outlet of Pend Oreille Lake, in the northern part of Idaho.

The obstructions to navigation consist of rocks and shoals in Box Canyon and in the section between this canyon and Albany Falls.

The original and existing project, adopted by Congress by act of March 3, 1899, contemplates the improvement of Box Canyon by the removal of submerged rocks, the blowing off of projecting rocky points, and the removal of submerged rocks between Box Canyon and Albany Falls. The estimated cost was $30,000.

The amount expended to June 30, 1908, was $22,428.20, of which $1,546.16 was for maintenance and inspections.

During the year no work has been done.

Box Canyon is now navigable, except at high stages of water.

The river is navigable throughout the year from Newport down to Box Canyon, a distance of 54 miles, except occasional interruption from ice. A channel depth of about 4 feet can be depended on.

The extreme variation of water levels in the main river is from 17 to 20 feet; in Box Canyon the difference between extreme high and extreme low water is 48 feet.

The commerce consists of towing logs and general traffic carried on by a number of small vessels. Heavy freight is carried mainly on barges in tow.

Exports and imports.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1899	2,617	$129,677	1904	39,974	$358,453
1900	1,921	97,125	1905	54,733	462,814
1901	13,917	134,280	1906	32,943	501,834
1902	15,868	500,200	1907	2,227	152,500
1903	27,100	753,000			

No effect on freight rates directly attributable to the improvement has been reported.

Descriptions of the river and the plan of improvement are given in the Annual Report of the Chief of Engineers for 1898, page 3124.

Report of survey of the river is referred to in the Annual Report of the Chief of Engineers for 1904, page 702.

The river and harbor act of March 2, 1907, appropriated $20,000 for work on this river and the Okanogan. It is proposed to apply the greater portion of this sum on the Pend Oreille in dredging through the clay bars between Newport and Box Canyon.

Proposals were invited August 16, 1907, for this work, but none were received. A second advertisement made during the past month resulted in the receipt of one conditional proposal to do the work at 50 cents per cubic yard. This proposal has been rejected and the work will be done by hired labor.

July 1, 1907, balance unexpended	$18,820.69
To transfer from Okanogan River on account of error	2,000.00
	20,820.69
June 30, 1908, amount expended during fiscal year for maintenance of improvement	743.47
July 1, 1908, balance unexpended	20,077.22

CONSOLIDATED.

July 1, 1907, balance unexpended	22,877.48
June 30, 1908, amount expended during fiscal year for maintenance of improvement	818.47
July 1, 1908, balance unexpended	22,059.01

(See Appendix X X 13.)

14. Removing sunken vessels or craft obstructing or endangering navigation.—Removal of wreck Atlas.—During the summer of 1907 the ore barge *Atlas*, moored in the Duwamish River for about four years, sunk near the city of Georgetown and was abandoned by the owners.

The wreck was partially raised, removed from the Duwamish River, beached at the northern part of Elliott Bay, and burned. The work was completed on February 25, 1908, at a cost of $275.

EXAMINATIONS AND SURVEY MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations and survey required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of Blaine Harbor, Washington.—Report dated April 11, 1907, is printed in House Document No. 69, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

2. Preliminary examination for a ship canal connecting the waters of Puget Sound with Grays Harbor, Washington.—Report dated April 11, 1907, is printed in House Document No. 70, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the United States.

3. Survey of waterway connecting Puget Sound with Lakes Union and Washington, Washington.—Report dated December 2, 1907, is printed in House Document No. 953, Sixtieth Congress, first session. A plan for improvement at an estimated cost to the United States of $2,500,000 is presented.

The district officer was also charged with the duty of making preliminary examinations and surveys provided for in the river and harbor act of March 2, 1907, as follows, and reports thereon will be duly submitted when received:

1. Puyallup River, Washington, up to the city of Puyallup.
2. Skagit River, Washington, to Sedro-Woolley.
3. Bellingham Harbor, Washington.
4. Snohomish River, Washington, from the mouth to Lowell.
5. Chehalis River up to Montesano, Wash.

RIVER AND HARBOR IMPROVEMENT IN THE DISTRICT OF ALASKA.

This district was in the charge of Capt. G. B. Pillsbury, Corps of Engineers. Division engineer, Lieut. Col. S. W. Roessler, Corps of Engineers.

1. St. Michael Canal, Alaska.—The St. Michael Canal is a channel running from St. Michael Bay to a point on Norton Sound about 38 miles from the Apoon mouth of the Yukon River.

The port of St. Michael is about 3 miles from the mouth of the canal.

The main part of the canal has sufficient water for the navigation of river boats plying on the Yukon River. The eastern entrance to the canal is, however, obstructed by shoals, and in the eastern portion there are several sharp bends that could be turned with difficulty by the larger river boats.

The object of the improvement of the canal is to provide a sheltered passage to river boats between St. Michael and the mouth of the Yukon River.

The original and existing project contemplates dredging in the South Branch a channel 100 feet wide to a depth of 6 feet at the entrance to the canal and the excavation of a cut of the same dimensions across the first bends. The estimated cost is $248,000. The project was adopted by the act of March 2, 1907, and the full amount of the estimate has been appropriated.

To June 30, 1908, there has been expended on the existing project $2,758.57. The sum of $7.60 has been derived from refundment of overpayment.

The work is being done under a continuing contract and was begun on the opening of navigation in June, 1908.

The maximum draft that can at present be carried at low water is 3 feet. The mean range of tide is 3½ feet.

Statement of freight between St. Michael and mouth of Yukon River.

Calendar year.	Tons.	Value.	Calendar year.	Tons.	Value.
1897	5,270	$512,650	1903	20,000	$1,652,891
1898	22,117	2,132,580	1904	17,356	1,316,237
1899	17,295	1,704,525	1905	25,855	2,220,830
1900	19,153	1,950,950	1906	31,999	2,799,187
1901	18,153	1,844,651	1907	29,793	2,493,697
1902	16,008	1,630,950			

It is not expected that this improvement will have any effect on freight rates.

July 1, 1907, balance unexpended	$98,000.00
Refundment of overpayment	7.60
Amount appropriated by sundry civil act approved May 27, 1908	150,000.00
	248,007.60
June 30, 1908, amount expended during fiscal year for works of improvement	2,758.57
July 1, 1908, balance unexpended	245,249.03
July 1, 1908, outstanding liabilities	1,819.31
July 1, 1908, balance available	243,429.72
July 1, 1908, amount covered by uncompleted contracts	235,000.00

(See Appendix Y Y 1.)

2. Removing sunken vessels or craft obstructing navigation, wreck Rock Island.—This wreck was sunk in the Tanana River, Alaska, in front of the town of Chena. It was reported to the Department April 27, 1907, and its removal was completed in March, 1908, at a total cost of $1,450.37.

(See Appendix Y Y 2.)

EXAMINATIONS MADE IN COMPLIANCE WITH RIVER AND HARBOR ACT APPROVED MARCH 2, 1907.

Reports on preliminary examinations required by the river and harbor act of March 2, 1907, of the following localities within this district were duly submitted by the district officer. They were reviewed by the Board of Engineers for Rivers and Harbors, pursuant to law, and were transmitted to Congress and printed in documents as indicated:

1. Preliminary examination of Dry Straits, Alaska.—Report dated June 3, 1907, is printed in House Document No. 556, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

2. Preliminary examination of Katalla Bay, Alaska, and adjacent bays.—Report dated January 17, 1908, is printed in House Document No. 907, Sixtieth Congress, first session. The locality is not considered worthy of improvement by the General Government.

RIVER AND HARBOR IMPROVEMENTS IN THE DISTRICT OF HAWAII.

This district was in the charge of Capt. C. W. Otwell, Corps of Engineers. Division engineer, Lieut. Col. John Biddle, Corps of Engineers.

1. Pearl Harbor, Hawaii.—For history and project, see page 3433 of the Annual Report of the Chief of Engineers for 1901. No work was done during this year. The expenditures were for tide gauge and office expenses. There is no commerce yet in this harbor; no further funds are required.

July 1, 1907, balance unexpended	$676.38
June 30, 1908, amount expended during the fiscal year for maintenance	223.72
July 1, 1908, balance unexpended	452.66
July 1, 1908, outstanding liabilities	26.72
July 1, 1908, balance available	425.94

(See Appendix Z Z 1.)

2. Honolulu Harbor, Hawaii.—This harbor is situated on the south coast of the island of Oahu. It is formed by a coral reef, through which a narrow channel afforded access to the harbor. The entrance channel and harbor proper were dredged from time to time by the monarchical, republican, and Territorial governments of Hawaii prior to July 1, 1904. On this date there existed an entrance channel having a depth of about 35 feet and a minimum width of about 200 feet at mean low water. The harbor proper (that portion commencing at the light-house and extending to the mouth of the Nuuanu River) had a general width of 900 feet. The water for about 200 feet immediately along the wharves had a depth of from 30 to 32 feet. Elsewhere there was only about 27 feet at low water. The bend at the light-house point was so sharp as to make it somewhat difficult for large vessels to make the turn. The shallowness of the water in the harbor made it impossible for the largest vessels calling at the port to enter the harbor when at all heavily laden. The narrowness of the harbor made turning difficult for all ships.

Work on the present project was begun under an appropriation by the river and harbor act of March 3, 1905, in accordance with a general plan printed in the Annual Report of the Chief of Engineers for 1905, page 2564, but the project as specifically adopted by the river and harbor act of March 2, 1907, is printed in House Document No. 332, Fifty-ninth Congress, second session. It provides for an entrance channel 35 feet deep and 400 feet wide at mean low water from deep water at the entrance to the light-house point, for easing the curve at the junction of the entrance channel and the inner harbor by cutting off the light-house point, and for enlarging the harbor proper so that it will have a depth of 35 feet and a general width of 1,200 feet at mean low water, at an estimated cost of $1,628,894.60, exclusive of a new front range light, estimated to cost $30,000.

The act of 1907 appropriated $200,000 and authorized continuing contracts for prosecuting the project in the additional sum of $200,000, which has since been appropriated.

Dredging is being carried on in Sections B and C under a continuing contract. The removal of the light-house point was practically completed, and work was commenced on the upper harbor end of Section C.

The sum of $3.33 was received on account of refundment of overpayment of employee.

On June 30, 1908, the sum of $431,614.98 had been expended; no part of this expenditure was for maintenance.

The work under the present project has resulted in an entrance channel 400 feet wide and 35 feet deep at mean low water, except near the marine railway and along the edges, where hard coral was encountered. Shoaling of about 1 foot in places has occurred near the outer end of the naval reservation, due to the littoral drift from the eastward. The harbor proper has a general width of 900 feet, a length of about 3,000 feet, and a minimum depth of about 35 feet, except in the upper basin where, due to the sediment brought down by the Nuuanu stream, there has developed a shoal of 33 feet over a strip 50 to 100 feet wide and 250 feet long.

For detailed statement of lands reclaimed with materials dredged in connection with the improvement, see page 788 of the Annual Report of the Chief of Engineers for 1906.

The commerce of this port for the past calendar year was valued at $34,948,746, and amounted to more than 386,389 tons.

July 1, 1907, balance unexpended	$237,529.40
Refundment of overpayment	3.33
Amount appropriated by sundry civil act approved May 27, 1908	200,000.00
	437,532.73
June 30, 1908, amount expended during fiscal year for works of improvement	69,136.38
July 1, 1908, balance unexpended	368,396.35
July 1, 1908, outstanding liabilities	1,687.26
July 1, 1908, balance available	366,709.09
July 1, 1908, amount covered by uncompleted contracts	355,825.58
Amount (estimated) required for completion of existing project	828,894.60
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	500,000.00

(See Appendix Z Z 2.)

3. *Reclamation of Quarantine Island, Honolulu, Hawaii.*—Quarantine Island was originally a low, swampy island lying on the reef on the side of Honolulu Harbor opposite the city. The quarantine authorities had scraped up the shallow layer of sand overlying the coral reef, and raised the land immediately surrounding the buildings and the roads to a height of about 2 feet above high water. Practically all the rest of the island was submerged at high water.

The original project, adopted February 27, 1906, provides for reclaiming the low and swampy portions of Quarantine Island lying within the concrete sea wall by pumping materials dredged from Honolulu Harbor to fill the same, at an estimated cost of $20,000.

A contract was entered into on April 10, 1906, and completed on August 6, 1906. A survey made in October, 1906, showed a considerable portion of the island below grade and large cracks appearing, due to the drying out of the materials.

Work was carried on under the project approved June 17, 1907, which provides for bringing the low places to grade by filling in, by means of a hoisting engine and scraper, materials lying on the coral reef in *front of the* sea wall, and was suspended March 4, 1908, when

funds were exhausted, 9,783.5 cubic yards of material having been placed on the island in this manner.

The sum of $2.67 was received, being a refundment of overpayment of employee.

At the close of the fiscal year the sum of $19,999.92 had been expended, leaving a balance of $2.75. No part of this expenditure was for maintenance.

For commercial statistics, see report for improving Honolulu Harbor, Hawaii.

July 1, 1907, balance unexpended	$3,628.54
Amount refunded	2.67
	3,631.21
June 30, 1908, amount expended during fiscal year for works of improvement	3,628.46
July 1, 1908, balance unexpended	2.75
July 1, 1908, outstanding liabilities	2.75

(See Appendix Z Z 3.)

4. Harbor at Hilo, Hawaii.—Hilo Bay is practically an open roadstead, protected to a limited extent by Blonde reef, but otherwise exposed through the angle formed by lines drawn from Hilo town to Kanaha and Keokea points—that is, from about north to north 74° east magnetic. Strong northeasterly winds prevail most of the time. These winds cause a choppy sea outside of Hilo Bay and considerable swell in the bay, which at times makes it unsafe for ships to lie at the existing wharves, and renders loading and unloading in the bay difficult. The heaviest seas, however, come from the north during northerly and northwesterly storms, and during this weather it is often impossible for ships to lie at the wharves or even work in the bay.

The present project consists in constructing a rubble mound breakwater along Blonde reef to a point on shore about 6,000 feet east of Cocoanut Island, at an estimated cost of $1,700,000. The original project is printed in House Document No. 407, Fifty-ninth Congress, second session, the modification of the location shown therein being the elimination of the third or shore arm and extension of the second arm to shore, so as to include a deep pocket east of Cocoanut Island.

The project was adopted by the river and harbor act of March 2, 1907, which appropriated $200,000 and authorized continuing contracts for prosecuting the work in the additional sum of $200,000, of which $100,000 is yet to be appropriated.

A contract for the construction of the breakwater was entered into, but at the close of the fiscal year no actual work on the breakwater had been done.

On June 30, 1908, the sum of $1,725.13 had been expended; no part of this expenditure was for maintenance.

The commerce of this port for the calendar year 1907 was valued at $7,007,923. This amount does not include the local commerce between Hilo and island ports, a statement of which could not be obtained.

July 1, 1907, balance unexpended	$200,000.00
Amount appropriated by sundry civil act approved May 27, 1908	100,000.00
	300,000.00
June 30, 1908, amount expended during fiscal year for works of improvement	1,725.13
July 1, 1908, balance unexpended	298,274.87
July 1, 1908, outstanding liabilities	260.78
July 1, 1908, balance available	298,014.09
July 1, 1908, amount covered by uncompleted contracts	260,000.00
Amount (estimated) required for completion of existing project	1,400,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908. Submitted in compliance with requirements of sundry civil act of June, 4, 1897.	*600,000.00

(See Appendix Z Z 4.)

RIVER AND HARBOR IMPROVEMENT IN THE DISTRICT OF PORTO RICO.

This district was in the charge of Maj. Charles L. Potter, Corps of Engineers. Division engineer, Col. D. W. Lockwood, Corps of Engineers.

1. Harbor at San Juan, Porto Rico.—This harbor has a very large area, but only a small portion is of a depth sufficient to accommodate modern shipping. There is a small area in the bend, where final entrance is made to the harbor proper, with a depth of 30 feet; the remainder of the available harbor ranges from 20 to 30 feet. A very narrow and somewhat crooked entrance channel has a least depth of 27 feet. The usual variation in water level between high and low tide is only about 1 foot. The existing project adopted by the river and harbor act of March 2, 1907, is to dredge an entrance channel 600 feet wide from deep water outside to a point opposite Morro Point; 500 feet wide from there to La Puntilla, both to be 30 feet deep, and both to be widened where they make the turn around these points; and to dredge, east of La Puntilla, harbor areas amounting to 398,600 square yards to a depth of 30 feet and 70,200 square yards to a depth of 24 feet, all in accordance with House Document No. 914, Fifty-ninth Congress, first session.

The estimated cost of this improvement is $757,500, of which the act of March 2, 1907, appropriated $157,500, and authorized continuing contracts for prosecuting the project in the sum of $600,000, of which $380,000 is still to be appropriated.

The work is being done under continuing contract at a cost of 19 cents for soft material and $6.80 for coral rock.

The amount expended to June 30, 1908, not including outstanding liabilities, was $74,158.75 for improvement.

The work done during the year ending June 30, 1908, has been to remove 135,944 cubic yards of soft material and 200 cubic yards of coral rock from the point at La Puntilla, and 361,322 cubic yards of soft material and 857 cubic yards of coral rock from the inner harbor,

* *Of this amount $100,000 is for continuing-contract work authorized by the river and harbor act of March 2, 1907.*

all the work being confined to areas which are to be dredged to a 30-foot depth. As a result, most of the area at La Puntilla is dredged to 30 feet, but some reefs have only 25 to 28 feet, as they are too hard to be dug with a dipper and have to be blasted. This depth is enough to carry any commercial vessel entering San Juan and the difficulty of making the turn around La Puntilla has been removed. In addition, 165,000 square yards of the harbor area have been dredged to a depth of 30 feet. The deepest draft that can be carried is still limited by the entrance channel to 27 feet.

No work was done by the United States prior to this project, but some dredging was done by the Spanish Government.

The amount estimated that can be profitably expended during the year ending June 30, 1910, will be expended in continuing dredging under the contract, which work is necessary to make the improvement available.

During the fiscal year ending June 30, 1907, the value of the commerce handled at San Juan, P. R., was:

Imports from the United States	$25,686,285
Imports from other countries	1,945,653
Exports to the United States	9,451,708
Exports to other countries	853,465

During the fiscal year ending June 30, 1908, as follows:

Imports from the United States	$22,677,376
Imports from other countries	3,148,289
Exports to the United States	25,891,281
Exports to other countries	4,753,209

The total number of vessels entering San Juan Harbor during the fiscal years ending June 30, 1907, and June 30, 1908, were:

	1907.	1908.
American	208	230
Foreign	186	184

The exports consist principally of sugar, tobacco, coffee, and fruit, and the imports consist of provisions, cloth goods, iron and steel, lumber, and general merchandise.

July 1, 1907, balance unexpended	$156,520.03
Amount appropriated by sundry civil act approved May 27, 1908	220,000.00
	376,520.03
June 30, 1908, amount expended during fiscal year for works of improvement	73,178.78
July 1, 1908, balance unexpended	303,341.25
July 1, 1908, outstanding liabilities	26,588.26
July 1, 1908, balance available	276,752.99
July 1, 1908, amount covered by uncompleted contracts	276,752.99
Amount (estimated) required for completion of existing project	380,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1910, for works of improvement, in addition to the balance unexpended July 1, 1908	380,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897.

(*See* Appendix A A A.)

2. Removing sunken vessels or craft obstructing or endangering navigation.—Wreck of the tugboat Mayaguez in the harbor of Ponce, P. R.—This wreck was removed at a total cost of $312.90.

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

Section 3 of the river and harbor act of June 13, 1902, provided for the organization, in the Office of the Chief of Engineers, by detail from time to time from the Corps of Engineers, of a Board of five engineer officers, whose duties shall be fixed by the Chief of Engineers, and to whom shall be referred for consideration and recommendation, in addition to any other duties assigned, so far as in the opinion of the Chief of Engineers may be necessary, all reports upon examinations and surveys provided for by Congress, and all projects or changes in projects for works of river and harbor improvement theretofore or thereafter provided for. It is further the duty of the Board, upon request to the Chief of Engineers, by the Committee on Commerce of the Senate, or the Committee on Rivers and Harbors of the House of Representatives, in the same manner to examine and report through the Chief of Engineers upon any projects heretofore adopted by the Government or upon which appropriations have been made, and to report upon the desirability of continuing the same or upon any modifications thereof which may be deemed desirable. This provision of the law was extended by act of March 3, 1905, to require the Board, upon request of the committees of Congress specified above, to examine and review surveys as well as projects provided for by acts or resolutions prior to the river and harbor act of June 13, 1902, and it was further modified by the act of March 2, 1907, to include consideration of any examination or survey made pursuant to any act or resolution of Congress.

During the past fiscal year the Board was composed of the following officers of the Corps of Engineers: Col. D. W. Lockwood; Col. R. L. Hoxie; Lieut. Col. Smith S. Leach, temporarily in connection with the consideration of Pacific coast improvements; Lieut. Col. Walter L. Fisk, temporarily in connection with the consideration of Pepperells Cove, Maine; Lieut. Col. Harry F. Hodges, from July 17, 1907, to June 25, 1908; Maj. E. Eveleth Winslow; Maj. Chester Harding, to July 17, 1907; and Capt. William J. Barden.

For consideration of the report of a Board of Engineers on the improvement of the Ohio River only, it was composed of the following officers of the Corps of Engineers: Col. H. M. Adams, Col. Charles E. L. B. Davis, Col. R. L. Hoxie, Lieut. Col. C. McD. Townsend, and Maj. E. Eveleth Winslow.

Under the provisions of the river and harbor act of March 2, 1907, all reports on preliminary examinations and surveys required by that act received up to the close of the fiscal year have been referred to the Board for consideration and recommendation; in addition, a number of subjects have been presented to it for report in accordance with resolutions of the Committee on Rivers and Harbors of the House of Representatives and the Committee on Commerce of the Senate. The reports rendered by the Board from time to time have been duly presented to Congress.

Details of the operations of the Board during the past fiscal year will be found in Appendix B B B.

EXAMINATIONS, SURVEYS, AND CONTINGENCIES OF RIVERS AND HARBORS.

For examinations, surveys, and contingencies of rivers and harbors, an appropriation of $300,000 should be made, as follows:

For examinations, surveys, and contingencies, and for incidental repairs for rivers and harbors for which there may be no special appropriation; for expenses connected with the inspection of bridges or other structures reported as obstructions to navigation, with the service of notices and holding of hearings when required in such cases, with the location of harbor lines under the act of March 3, 1899, and with the examinations and reports by officers of the Corps of Engineers, and by boards of engineers upon plans and sites for bridges or other structures authorized by law to be built, and upon bills authorizing bridges or other structures, reports upon which may be called for by Congress; and for other expenses connected with the performance of the duties which are, or may be, imposed by law upon the War Department in the protection and preservation of the navigable waters of the United States.

SUPERVISION OF THE HARBOR OF NEW YORK.

The supervisor of the harbor during the past year was Commander H. H. Hosley, U. S. Navy, to January 6, 1908; Lieut. D. C. Hanrahan, U. S. Navy, temporarily, from January 6 to May 14, 1908, and Capt. Aaron Ward, U. S. Navy, since May 14, 1908.

The office of supervisor of the harbor of New York was created by act of Congress approved June 29, 1888, entitled "An act to prevent obstructive and injurious deposits within the harbor and adjacent waters of New York City, by dumping or otherwise, and to punish and prevent such offenses." This act has been amended by section 3 of the act of August 18, 1894, entitled "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," by which amendment the functions and powers of the officer have been greatly enlarged. Additional duties are also conferred on the supervisor by section 2 of the last-named act. The functions and powers of the supervisor have been further extended by section 8 of act of Congress approved May 28, 1908, entitled "An act to amend the laws relating to navigation, and for other purposes."

Under the provisions of section 5 of the act of June 29, 1888, a line officer of the Navy is designated to discharge the duties created by the act, under the direction of the Secretary of War. On May 23, 1889, the Secretary of War directed that all communications in connection with these duties should be addressed to him through this office, and on February 1, 1890, he further directed that the powers conferred upon him by the act should be exercised through the Chief of Engineers.

The report of Captain Ward for the past fiscal year is submitted herewith as Appendix C C C.

Estimates for the fiscal year ending June 30, 1910.—The estimates of funds required for this service for the fiscal year ending June 30, 1910, are given in the above-mentioned report, as follows:

For pay of inspectors, deputy inspectors, office force, and expenses of office	$10,260.00
For pay of crews and maintenance of patrol fleet	80,000.00
For renewing engines and boilers of steam tug *Vigilant*	15,000.00
For purchase or construction of one steam tug	50,000.00
Total	155,260.00

CALIFORNIA DÉBRIS COMMISSION.

Unrestricted mining by the hydraulic process in California resulted in enormous quantities of débris being washed down into the rivers and natural water courses draining the western slopes of the Sierras. Later on hydraulic mining was practically prohibited by the decisions of the courts on account of injury to streams and the adjacent private land.

The act of Congress approved March 1, 1893, created the California Débris Commission, stipulating that the Commission should consist of three officers of the Corps of Engineers, appointed by the President with the concurrence of the Senate. The same act prescribed the duties of the Commission, which are, first, the regulation of hydraulic mining in the territory drained by the Sacramento and San Joaquin river systems, so that mining by that method may be resumed and carried on without injury to other interests in the State, and, second, to mature and adopt plans to improve the navigability of the above-mentioned rivers, to protect same from damage due to mining débris, and to afford relief thereto in flood time.

Regulation of hydraulic mining.—Up to June 30, 1908, the Commission received 820 applications for permits to mine by the hydraulic process under the restrictions imposed by the act of Congress of March 1, 1893, and granted permits in cases where means for properly impounding the débris were provided by the applicants.

Improvement and protection of rivers and flood control.—The Yuba River, a tributary of the Feather, which in turn is a tributary of the Sacramento River, was the first selected for treatment, this stream being more filled with débris and perhaps carrying more detritus than all the other tributaries of the Sacramento combined. The general project for the treatment of the Yuba was printed in the Annual Report of the Chief of Engineers for 1900, Part 8, page 5030. The estimated total cost of this project was placed at $800,000. It was adopted by act of Congress approved June 13, 1902. The estimated total cost of the project has been appropriated—$400,000 by Congress and $400,000 by the legislature of California, the appropriations by Congress stipulating that one-half the cost of the work should be paid by the State of California.

The Yuba River project contemplates holding the great quantities of mine débris now in that stream and tributaries, to prevent it from being carried down into the Feather and Sacramento rivers, this to be accomplished by restraining barriers, or dams, across the bed of the Yuba, by a settling basin adjoining the river on the south, and by training walls below.

The amount expended by the United States on the existing project for the work in the Yuba River, up to June 30, 1908, was $268,085.46. These expenditures were principally in payment of one-half the purchase price of upward of 10,000 acres of land; in payment of one-half the cost of the construction of portions of barriers, or dams, in

Yuba River, known as Nos. 1 and 2; of one-half the cost of excavating a flood overflow channel through the promontory on Yuba River known as Daguerre Point, and of one-half the cost of constructing a portion of the proposed training walls to confine the flow of Yuba River below Daguerre Point.

In a special report dated June 30, 1907 (submitted to comply with sections 5, 6, and 7 of the act of Congress of March 1, 1893), printed in the Annual Report of the Chief of Engineers for 1907, pages 2262-2269, the Commission estimated that the restraining works already constructed and remaining to be built under the present project for the treatment of Yuba River would provide capacity for storing 60,000,000 cubic yards of débris in that stream. The Commission stated in this special report, however, that dredging was considered the most feasible method to meet the requirements of all the interests involved—navigation, protection from flood overflow, better drainage, and disposal and control of débris in the Sacramento and Feather rivers.

The Commission reports that from surveys made and from other surveys soon to be completed data will be available for use in preparing, during the ensuing year, a project for thorough control of the rivers at all stages.

The maintenance of navigation on the Sacramento and San Joaquin river systems is important. Upward of 1,000,000 tons of freight and 300,000 passengers are carried annually by vessels of all classes plying the Sacramento, San Joaquin, Mokelumne, and Feather rivers. The freight consists principally of grain, mill stuffs, lumber, groceries, fruit, vegetables, and general merchandise, and is carried principally on barges towed by steamboats and on scow-schooners. About 45 steamboats, many barges, launches, and scow-schooners are engaged in this trade.

Much of the fertile country along the Sacramento and San Joaquin rivers is without railroad transportation, owing to the expense and difficulties of the construction and maintenance of railroads in a low-land country which is subject to more or less widespread floods annually. These fertile lands, great areas of which are under a high state of cultivation, are protected ordinarily from overflow by extensive levee systems, constructed and maintained at great expense, and the rivers are in many cases the only means of transporting freight and passengers to and from most of this country. The lower rates by river to some points which can also be reached by railroads are in some cases met by the latter.

The following statement shows the present condition for purposes of navigation of the three principal streams comprising the Sacramento and San Joaquin river systems:

	Sacramento River.	Feather River.	San Joaquin River
Maximum draft that can be carried at low water.	San Francisco to Sacramento, 7 feet; Sacramento to Colusa, 4 to 5 feet; Colusa to Red Bluff, 2 to 2½ feet.	Mouth of river to Marysville, 1 to 2 feet.	Mouth of river to Stockton, 9 feet; Stockton to Firebaugh, a few inches.
Head of navigation...	Red Bluff.....	Marysville.....	Stockton (Firebaugh, 4 months in year).
Length of navigable portions.	Mouth to Sacramento, 61 miles; mouth to Colusa, 152 miles; mouth to Red Bluff, 262 miles.	Mouth to Marysville, 30 miles.	Mouth to Stockton, 50 miles; mouth to Firebaugh, 255 miles.

More extended information concerning navigation, flood control, and the mine-débris question in and along the Sacramento and San Joaquin rivers and their tributaries may be found in the following-named Annual Reports of the Chief of Engineers, and in House Document No. 262, Fifty-ninth Congress, first session, for Sacramento, San Joaquin, and Feather rivers and tributaries:

Annual report for fiscal year—	Part.	Pages.	River.
1871	.....	914-917	Sacramento.
1875	2	697-707	Do. Feather.
1875	2	726-729	San Joaquin.
1877	2	994-996	Sacramento.
1878	2	1294-1299	Do. Feather.
1879	2	1749-1761	Sacramento. Feather.
1880	3	2233-2242	Sacramento.
1881	3	2485-2515	Sacramento, San Joaquin, and tributaries (mine débris).
1882	3	2543-2640	Do.
1882	3	2637-2640	Mokelumne.
1883	3	1976-1982	San Joaquin.
1885	3	2359-2360	Mokelumne.
1885	3	2373-2374	Yuba.
1891	5	2996-3118	Sacramento, San Joaquin, and tributaries (mine débris)
1891	5	2990-2995	Sacramento. Feather.
1891	5	3133-3137	Mokelumne.
1893	4	3290-3297	San Joaquin.
1893	4	3301-3303	Stanislaus.
1893	4	3299-3301	Tuolumne.
1894	6	3169-3187	Sacramento, San Joaquin, and tributaries (mine débris).
1895	5	3335-3338	American (mine débris).
1895	5	3325-3328	Feather.
1895	5	3338-3339	San Joaquin.
1896	5	3223-3226	Sacramento.
1896	5	3219-3223	San Joaquin.
1898	4	2944-2945	Sacramento. Feather.
1899	4	3171-3181	Sacramento Feather.
1899	4	3188-3193	San Joaquin.
1900	8	5030-5070	Yuba (mine débris).
1901	4	3454-3459 3449-3453	San Joaquin.
1907	3	2262-2269	Sacramento, San Joaquin, Feather, and tributaries (navigation, control of floods, and control and disposal of mine débris).

The members of the Commission during the past fiscal year were Lieut. Col. John Biddle, Maj. C. H. McKinstry, and Capt. Thos. H. Jackson.

The appended money statement for appropriation for restraining mine débris in California includes only funds appropriated by Congress, and does not include funds appropriated by the legislature of California.

APPROPRIATION FOR EXPENSES OF CALIFORNIA DÉBRIS COMMISSION, 1908.

July 1, 1907, amount appropriated by act of Congress approved March 4, 1907	$15,000.00
June 30, 1908, amount expended during fiscal year	[a] 13,557.25
July 1, 1908, balance unexpended	1,442.75
July 1, 1908, outstanding liabilities	1,142.75
July 1, 1908, balance reverting to Treasury	300.00

[a] In addition there was expended during the year $5.96 from appropriation for fiscal year 1906 and $863.75 from appropriation for fiscal year 1907.

APPROPRIATION FOR EXPENSES OF CALIFORNIA DÉBRIS COMMISSION, 1909.

Amount appropriated by act of Congress approved May 27, 1908	$15,000.00
Amount (estimated) required for expenses of the California Débris Commission during the fiscal year ending June 30, 1910, in regulating hydraulic mining operations in the State of California, making examinations and surveys for improvement of navigation, control and disposition of mine débris, and control of flood waters as required by the act of Congress approved March 1, 1893	15,000.00

APPROPRIATION FOR RESTRAINING MINE DÉBRIS IN CALIFORNIA.

July 1, 1907, balance unexpended	$141,413.78
June 30, 1908, amount received during fiscal year from sale of Government property	128.00
	141,541.78
June 30, 1908, amount expended during fiscal year for works of improvement	9,499.24
July 1, 1908, balance unexpended	132,042.54
July 1, 1908, outstanding liabilities payable by United States	4,453.25
July 1, 1908, balance available	127,589.29
July 1, 1908, amount of United States funds covered by uncompleted contracts	22,017.50

(See Appendix D D D.)

EXAMINATION OF MISSISSIPPI RIVER WITH A VIEW TO PROVIDING AND MAINTAINING A NAVIGABLE CHANNEL 14 FEET DEEP AND OF SUITABLE WIDTH FROM ST. LOUIS TO THE MOUTH.

Under the provisions of the river and harbor act of March 2, 1907, a Commission has been appointed to examine the Mississippi River below St. Louis and report upon the practicability and desirability of constructing and maintaining a navigable channel 14 feet deep and of suitable width from St. Louis to the mouth of the river either by open-channel improvement or by a canal or canals for part of said route. The Commission is also required by the act to consider in this connection the survey of a proposed waterway from Chicago to St. Louis heretofore reported upon (see H. Docs. No. 263, 59th Cong., 1st sess., and No. 437, 59th Cong., 2d sess.), and also to report upon any water power which may be created in the said section of the Mississippi River below St. Louis, as well as in the proposed waterway from Chicago to St. Louis, and what steps, if any, should be taken to cause the cost of improvement to be defrayed in whole or in part by means of such water power or of lands which may be drained by either of said waterways.

The members of the Commission are Col. W. H. Bixby, Corps of Engineers, president, Mississippi River Commission; Lieut. Col. C. McD. Townsend, Corps of Engineers; Lieut. Col. J. G. Warren, Corps of Engineers; Mr. Henry B. Richardson, member of the Mississippi River Commission, and Mr. Homer P. Ritter, member of the Mississippi River Commission, with Capt. G. R. Lukesh, Corps of Engineers, as recorder.

The sum of $190,000 was appropriated by the act to defray the expense of the survey, of which $112,024.83 had been expended to June 30, 1908. The expenditure during the year amounted to $111,774.13.

MISSISSIPPI RIVER COMMISSION.

The Mississippi River Commission, constituted by act of Congress of June 28, 1879, is in charge of the improvement of the Mississippi River from Head of Passes to the mouth of the Ohio River, including the rectification of Red and Atchafalaya rivers at their junction with the Mississippi, the building of levees, and the improvement of the several harbors for which specific appropriations have been made, with the exception of the harbor of Vicksburg and the mouth of Yazoo River. It is also charged with the survey of the Mississippi River from Head of Passes to its headwaters, and with gauging the river and its tributaries.

The river and harbor acts of March 3, 1905, and March 2, 1907, prescribed that the money therein appropriated and authorized to be expended should be applied to the construction of suitable and necessary dredge boats and other devices and appliances and in the maintenance and operation of the same, with the view of ultimately obtaining and maintaining a navigable channel from Cairo down not less than 250 feet in width and 9 feet in depth at all periods of the year, except when navigation is closed by ice. They also authorized allotments from such funds in the discretion of the Commission and upon approval by the Chief of Engineers, to be applied to the water courses connected with the river and the harbors upon it now under the control of the Mississippi River Commission.

Act of Congress approved June 4, 1906, provides that any funds which have been, or may hereafter be, appropriated by Congress for improving the Mississippi River between the Head of Passes and the mouth of the Ohio River, and which may be allotted to levees, may be expended under the direction of the Secretary of War, in accordance with the plans, specifications, and recommendations of the Mississippi River Commission, as approved by the Chief of Engineers, upon levees upon any part of said river between the Head of Passes and Cape Girardeau, Mo.

The act of March 2, 1907, provided for prosecution of the work under continuing contract and authorized expenditures in the sum of $6,000,000 (of which $4,000,000 yet remains to be appropriated), provided that this sum shall be used in improvement for not less than three years, the work done each year to cost approximately $2.000,000.

The Commissioners during the past fiscal year were Col. Clinton B. Sears, Corps of Engineers, president, to March 14, 1908; Col. Wm. H. Bixby, Corps of Engineers, president, since March 14, 1908; Col. Wm. T. Rossell, Corps of Engineers; Lieut. Col. J. G. Warren, Corps of Engineers; Homer P. Ritter, assistant, United States Coast and Geodetic Survey; Robert S. Taylor, J. A. Ockerson, and Henry B. Richardson.

Capt. G. R. Lukesh, Corps of Engineers, was on duty as secretary to the Commission during the year.

The report of the Commission on the operations under its charge during the fiscal year ending June 30, 1908, is submitted herewith as Appendix P P P of this report.

Estimate for the fiscal year ending June 30, 1910.—The following estimate of funds required for carrying on the works under its charge for the year ending June 30, 1910, is submitted by the Commission:

For continuing the improvement of Mississippi River from Head of Passes to the mouth of the Ohio River, including salaries and clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission $3,000,000

The estimate has been reduced in this office to $2,000,000.

PERMANENT INTERNATIONAL COMMISSION OF THE CONGRESSES OF NAVIGATION.

By act approved June 28, 1902, Congress appropriated the sum of $3,000 per year for the support and maintenance of the Permanent International Commission of the Congresses of Navigation and for the payment of the actual expenses of the properly accredited national delegates of the United States to the meeting of the congresses and of the Commission.

At the beginning of the fiscal year the United States was represented on the Permanent International Commission of the Congresses of Navigation by Brig. Gen. C. W. Raymond, U. S. Army, retired; Mr. E. L. Corthell, civil engineer; Maj. H. F. Hodges, Corps of Engineers; Maj. J. C. Sanford, Corps of Engineers, and Mr. John Bogart, civil engineer. On the permanent executive committee of that Commission it was represented by General Raymond as the principal representative and Mr. E. L. Corthell as the substitute. The representation on the Commission and on the executive committee has remained unchanged during the year. Major Sanford attended a meeting of the Commission held at St. Petersburg, Russia, May 31, 1908.

The Eleventh International Congress of Navigation was held at St. Petersburg, Russia, May 31 to June 7, 1908. The following-named delegates were appointed to represent the United States at this meeting: Maj. J. C. Sanford, Corps of Engineers, chairman; Lieut. Com. F. L. Chapin, U. S. Navy; Maj. Spencer Cosby, Corps of Engineers, Mr. J. A. Ockerson, civil engineer, member Mississippi River Commission, and Mr. Arsene Perrilliat, civil engineer. All of these delegates, except Mr. Perrilliat, attended the meeting of the congress.

The expenditures during the year from the appropriation made by Congress have been for the expenses of the American Section in attending its meetings and of the properly accredited delegates to the meeting of the Eleventh International Congress, the maintenance of the executive office of the American Section, and for the support and maintenance of the Commission, to which the United States contributes $1,000 per annum.

ESTABLISHMENT OF HARBOR LINES.

Under authority given to the Secretary of War in section 11 of the river and harbor act approved March 3, 1899, harbor lines have been established during the past fiscal year at the following localities, under dates as indicated:

Shaws Cove, New London Harbor, Connecticut, August 9, 1907; Arthur Kill, New York and New Jersey, around Buckwheat Island,

July 25, 1907; Passaic River, New Jersey, August 21, 1907; Hackensack River, New Jersey, December 7, 1907; Shrewsbury River, New Jersey, December 5, 1907; Tanners Creek, Virginia, August 15, 1907; Hillsboro Bay, Florida, December 2, 1907; Niagara River at Tonawanda, N. Y., July 15, 1907; Willapa River at South Bend, Wash., May 28, 1908; and Lake Union at Seattle, Wash., January 4, 1908.

RULES AND REGULATIONS GOVERNING THE OPENING OF DRAWBRIDGES.

Section 5 of the river and harbor act of August 18, 1894, provides that it shall be the duty of all persons owning, operating, and tending the drawbridges then built or which might thereafter be built across the navigable rivers and other waters of the United States, to open or cause to be opened the draws of such bridges, under such rules and regulations as in the opinion of the Secretary of War the public interests require, for the passage of vessels and other water craft. Such rules and regulations have been established during the past year by the Secretary of War for certain drawbridges over the following-named waterways:

York River at York, Me.; Mystic River at Mystic, Conn.; Annsville Creek near Peeksville, N. Y.; channel between Little Annemessex River and Somers Cove at Crisfield, Md.; Newport River at Morehead City and Beaufort, N. C.; Louisville and Nashville Railroad bridges over Tensas River, Mobile River, Bayou Conner, Bayou Sara, Chickasaw Creek, Threemile Creek, and Onemile Creek, Alabama; Pascagoula River, Biloxi Bay, East Pearl River, and Bay St. Louis, Mississippi, and the Rigolets, Louisiana; Morgan's Louisiana and Texas Railroad and Steamship Company and Louisiana and Western Railroad Company bridges over Barrows Canal, Bayou Courtableau, Berwick Bay, Bayou Boeuf, Bayou Lafourche, Bayou des Allemands, Harvey Canal, Company Canal, Bayou Lacassine, Bayou Vermilion, Mermentau and Calcasieu rivers, Louisiana, and Sabine River, Louisiana and Texas; Cumberland River, Tennessee and Kentucky; Los Angeles River at Long Beach, Cal.; Columbia River below Vancouver, Wash.; and Willamette River at St. Johns, Oreg.

RULES AND REGULATIONS GOVERNING THE NAVIGATION OF CANALS, ETC.

Section 4 of the river and harbor act of August 18, 1894, as amended by section 11 of the river and harbor act of June 13, 1902, delegates to the Secretary of War the duty of prescribing such rules and regulations for the use, administration, and navigation of any or all canals and similar works of navigation that now are or that hereafter may be owned, operated, or maintained by the United States as in his judgment the public necessity may require; and he is also authorized to prescribe regulations to govern the speed and movement of vessels and other water craft in any public navigable channel which has been improved under authority of Congress, whenever in his judgment such regulations are necessary to protect such improved channels from injury or to prevent interference with the operations of the United States in improving navigable waters or

injury to any plant that may be employed in such operations. Such rules and regulations have been established during the past year for the following-named localities:

Ship channel at Gulfport, Miss.; and Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.

STRUCTURES IN THE NAVIGABLE WATERS OF PORTO RICO.

Act of Congress approved June 11, 1906, empowered the Secretary of War, under certain restrictions, to authorize the construction, extension, and maintenance of wharves, piers, and other structures on lands underlying harbor areas and navigable streams and bodies of water in or surrounding Porto Rico and the islands adjacent thereto.

Through a conference between the district officer and the governor of Porto Rico a definite policy has been established and is followed in connection with applications for privileges under this law, several applications having been acted on during the year.

BRIDGING NAVIGABLE WATERS OF THE UNITED STATES.

Plans and maps of locations of the following bridges proposed to be erected under the authority of special acts of Congress have been examined with a view to protection of the interests of navigation and have been approved by the Secretary of War, as provided by the acts, and the local engineer officers have been furnished copies of the instruments of approval and drawings showing plans and locations and charged with the supervision of the construction of the bridges, so far as necessary, to see that they are built in accordance with the approved plans:

Bridge of the St. Louis Electric Bridge Company (McKinley Bridge) over Mississippi River at Salisbury street, St. Louis, Mo.—Construction of this bridge was authorized by act of Congress approved February 15, 1907. Plans and map of location were approved July 5, 1907.

Bridge of the Burnwell Coal and Coke Company over Tug Fork of Big Sandy River, near Sprigg, W. Va.—Construction of this bridge was authorized by act of Congress approved March 2, 1907. Plans and map of location were approved July 23, 1907.

Bridge of the Arkansas, Louisiana and Gulf Railway Company over Bayou Bartholomew, La.—Plans and map of location of a bridge to be built at this place under authority of acts of Congress approved March 23, 1906, and February 27, 1907, were approved September 20, 1907.

Bridge of the Pittsburgh and Lake Erie Railroad Company over Ohio River at Beaver, Pa.—Plans for rebuilding an existing structure at this place were duly considered by a Board of Engineers, pursuant to the requirements of act of Congress approved December 17, 1872, as amended by act of February 14, 1883, and were approved October 29, 1907.

Bridge of the New Orleans Great Northern Railroad Company over Pearl River, in Marion County, Miss.—Construction of this bridge was authorized by act of Congress approved February 25, 1907. Plans and map of location were approved November 6, 1907.

Bridge of the Alaska Pacific Railway and Terminal Company over Copper River, near Childs Glacier, Alaska.—Construction of this bridge was authorized by act of Congress approved June 30, 1906. Plans and map of location were approved November 16, 1907.

Bridge of the Majestic Collieries Company over Tug Fork of Big Sandy River, near Devon, W. Va.—Construction of this bridge was authorized by act of Congress approved February 8, 1907. Plans and map of location were approved February 6, 1908.

Bridge of Allegheny County, Pa., over Ohio River at Sewickley.—Construction of a bridge at this place was authorized by act of Congress approved December 17, 1872, as amended by act of February 14, 1883. Plans and map of location were considered by a Board of Engineers, as required by law, and were approved February 6, 1908.

Bridge of the Ashland and Ironton Bridge Company over Ohio River at Ashland, Ky., and Ironton, Ohio.—Plans for construction of this bridge under authority of act of Congress approved December 17, 1872, as amended by act of February 14, 1883, were approved April 22, 1901, and reapproved February 15, 1905. The statutory time for completion having expired, the plans were reapproved February 14, 1908.

Bridge of the Atlantic Coast Line Railroad Company over St. Marys River, near Folkston, Ga.—Construction of a bridge at this place was authorized by act of Congress approved December 23, 1880. Plans for a bridge to replace an existing structure at this point were approved March 2, 1908.

Bridge of the Arizona and California Railway Company over Colorado River at Parker, Ariz.—Construction of this bridge was authorized by act of Congress approved February 6, 1908. Plans and map of location were approved March 3, 1908.

Bridge of the Kanawha and Michigan Railway Company over Ohio River at Point Pleasant, W. Va.—Plans for reconstruction of the side spans of this bridge were approved March 10, 1908.

Bridge of St. Francis County, Ark., over St. Francis River at Madison.—Plans and map of location for a bridge to be built at this place under authority of act of Congress approved January 16, 1908, were approved March 10, 1908.

Bridge of the Interstate Transfer Railway Company over St. Louis River near Duluth, Minn., and Superior, Wis.—Construction of this bridge was authorized by act of Congress approved February 20, 1908. Plans and map of location were approved March 16, 1908.

Bridge of the Union Depot Bridge and Terminal Company over Missouri River at Kansas City, Mo.—Plans and map of location of a bridge to be built at this place under authority of act of Congress approved March 3, 1887, as amended by subsequent acts, the latest being that approved February 20, 1907, were approved March 19, 1908.

Bridge of the city of St. Joseph, Mich., over St. Joseph River at State street.—Plans and map of location of a bridge proposed to be built at this place under authority of act of Congress approved March 6, 1908, were approved March 20, 1908.

Bridge of Campbell County, Tenn., over Powells River near Agee post-office.—Construction of this bridge was authorized by act of Congress approved February 20, 1908. Plans and map of location were approved April 24, 1908.

Bridge of Allegheny and Washington counties, Pa., over Monongahela River.—Plans and map of location of a bridge at this place authorized by act of Congress approved April 3, 1908, were approved May 21, 1908.

Bridge of the Missouri and North Arkansas Railroad Company over Cache River in Woodruff County, Ark.—Plans and map of location of a bridge at this place authorized by act of Congress approved February 1, 1908, were approved May 26, 1908.

Bridge of the city of Bemidji, Minn., over Mississippi River.—Construction of this bridge was authorized by act of Congress approved May 20, 1908. Plans and map of location were approved June 18, 1908.

Under the provisions of section 9 of the river and harbor act approved March 3, 1899, bridges may be built over navigable waters entirely within the limits of any State, under authority of legislative enactment of such State, when the plans and locations of the structures are approved by the Secretary of War. Plans and maps of locations of the following bridges proposed to be erected under these provisions have been examined with a view to protection of the interests of navigation and have been approved by the Secretary of War, and the local engineer officers have been furnished copies of the drawings and instruments of approval and charged with the supervision of construction of the bridges, so far as necessary, to see that they are built in accordance with the approved plans:

Bridge of the parish of St. Landry over Bayou Courtableau at Port Barre, La.—Plans for reconstructing an existing bridge at this place were approved July 23, 1907.

Bridge of the Raritan River Railroad Company over South River at Sayreville and South River, N. J.—Plans for reconstruction of an existing bridge at this place were approved July 19, 1907.

Bridge of the city of Chicago, Ill., over Chicago River at Orleans and Franklin streets.—Plans and map of location were approved July 23, 1907.

Bridge of Bergen County, N. J., over Hackensack River at Court street, Hackensack.—Plans for rebuilding an existing structure were approved July 24, 1907.

Bridge of the town of York, Me., over York River.—Plans and map of location were approved April 11, 1907, and plans supplemental thereto were approved July 25, 1907.

Bridge of the city of Charleston, W. Va., over Elk River at Spring street.—Plans and map of location were approved July 31, 1907.

Bridge of the Tampa and Sulphur Springs Traction Company over Hillsboro River near Nebraska Avenue road, Hillsboro County, Fla.—Plans and map of location were approved July 31, 1907.

Bridge of the city of Lynn, Mass., over Little River.—Plans and map of location were approved August 1, 1907.

Bridge of the Lake Shore and Michigan Southern Railway Company over Swan Creek at Monroe street, Toledo, Ohio.—Plans and map of location were approved August 1, 1907.

Bridge of the Jones-Thompson Investment Company over Black River at Earlington, Wash.—Plans and map of location were approved August 2, 1907.

Bridges of Craven County, N. C., over Swift Creek (at Vanceboro) and Brices Creek.—Plans and maps of location were approved August 3, 1907.

Bridge of city of Milwaukee, Wis., over South Menominee Canal east of First Avenue Bridge.—Plans for a temporary bridge at this place were approved August 15, 1907.

Bridge of the city of Chicago, Ill., over North Branch of Chicago River at Erie street.—Plans and map of location were approved August 15, 1907.

Bridge of the Boston Elevated Railway Company over Charles River at Boston and Cambridge, Mass.—Plans and map of location were approved August 15, 1907.

Bridge of Union County, N. J., over Elizabeth River at South First street, Elizabeth.—Plans and map of location were approved August 15, 1907.

Bridge of Pacific County, Wash., over Nasel River.—Plans and map of location were approved August 16, 1907.

Bridge of Fayette County, Pa., over Cheat River at Point Marion and Springhill.—Plans and map of location were approved March 26, 1907. Modified plans in lieu thereof were approved August 21, 1907.

Bridge of the city of New York, N. Y., over Harlem River between the boroughs of Manhattan and the Bronx.—Plans and map of location were approved August 22, 1907.

Bridge of the Mengel Box Company over Obion River at Mengelwood (Bandmill), Tenn.—Plans and map of location were approved August 22, 1907.

Bridge of Iberville Parish, La., over Bayou Plaquemine at Plaquemine.—General plans for a bridge at this place to replace one destroyed by fire were approved March 25, 1907. Detailed plans were approved August 22, 1907.

Bridge of the Morgan's Louisiana and Texas Railroad and Steamship Company over Atchafalaya River at Morgan City, La.—Plans for rebuilding an existing bridge were approved August 26, 1907.

Bridge of the Morgan's Louisiana and Texas Railroad and Steamship Company over Bayou Boeuf in St. Mary and Assumption parishes, La.—Plans for reconstruction of this bridge were approved August 28, 1907.

Bridge of the Montgomery Bridge Company over Kanawha River at Montgomery, W. Va.—Plans and map of location were approved September 5, 1907.

Bridge of Chatham County, Ga., over Ogeechee River.—Plans for rebuilding an existing structure were approved September 5, 1907.

Bridge of the Trustees of Machiasport Bridge over Machias River at Machiasport and East Machias, Me.—Plans for reconstruction of this bridge were approved September 7, 1907.

Bridges of the Minneapolis, Rochester and Dubuque Traction Company over Minnesota River at Savage, Minn.—Plans and map of location of a permanent bridge and of a temporary bridge for use during construction of the permanent structure were approved September 9, 1907.

Bridge of the Northern Pacific Railway Company over Hoquiam River in Chehalis County, Wash.—Plans and map of location were

approved April 20, 1907. Modified plans in lieu thereof were approved September 10, 1907.

Bridge of the Great Northern Railway Company over Ball Club River in Itasca County, Minn.—Plans for a bridge at this place to replace an existing structure were approved September 10, 1907.

Bridge of the Great Northern Railway Company over Mississippi River in Cass and Itasca counties, Minn.—Plans for a bridge at this place to replace an existing structure were approved September 10, 1907.

Bridge of the New Orleans Great Northern Railroad Company over Bayou Lacombe in St. Tammany Parish, La.—Plans and map of location were approved September 10, 1907.

Bridge of Morgan's Louisiana and Texas Railroad and Steamship Company over Bayou des Allemands in Lafayette and St. Charles parishes, La.—Plans for reconstruction of this bridge were approved September 10, 1907.

Bridge of the Flanagan estate over Coal Bank Slough at Pennsylvania avenue, Marshfield, Oreg.—Plans and map of location were approved September 12, 1907.

Bridge of the city of Milwaukee, Wis., over Kinnickinnick River at Kinnickinnick avenue.—Plans for rebuilding this bridge were approved September 17, 1907.

Bridge of the Chicago, Milwaukee and St. Paul Railway Company over Kinnickinnick River near Kinnickinnick avenue, Milwaukee, Wis.—Plans for a bridge to replace an existing structure at this place were approved September 17, 1907.

Bridge of the Chicago and Northwestern Railway Company over Kinnickinnick River near Kinnickinnick avenue, Milwaukee, Wis.—Plans for rebuilding this bridge were approved September 17, 1907.

Bridge of the Seaboard Air Line Railway over Livingstone Creek near Cronly, N. C.—Plans for reconstruction of this bridge were approved September 19, 1907.

Bridges of Beaufort County, N. C., over Pungo and Pantego creeks.—Plans and map of location were approved September 20, 1907.

Bridge of Warren County, Miss., over Big Black River near Ivanhoe Ferry.—Plans and map of location were approved September 25, 1907.

Bridge of Galveston County, Tex., over West Galveston Bay at Galveston.—Plans and map of location were approved September 30, 1907.

Bridge of the Northern Pacific Railway Company over Cowlitz River at Olequa, Wash.—Plans for rebuilding an existing bridge were approved September 30, 1907.

Bridge of the Detroit, Grand Haven and Milwaukee Railway Company (Grand Trunk Railway), over Grand River near Grand Haven, Mich.—Plans for reconstruction of this bridge were approved September 30, 1907.

Bridge of the Cumberland River and Nashville Railroad Company over South Fork of Cumberland River near Burnside, Ky.—Plans and map of location were approved May 17, 1906. Modified plans in lieu thereof were approved October 3, 1907.

Bridge of Pitt County, N. C., over Tar River at Greenville.—Plans and map of location were approved October 7, 1907.

Bridge of the Chicago, Indianapolis and Evansville Railroad Company over White River near mouth of Conger Creek, Indiana.—Plans and map of location were approved October 23, 1907.

Bridge of the Beaumont, Sour Lake and Western Railway Company over Trinity River, Texas.—Plans and map of location were approved August 7, 1906. Modified plans in lieu thereof were approved October 31, 1907.

Bridge of the Missouri Valley Bridge and Iron Company over Brazos River near Wellborn, Tex.—Plans and map of location were approved November 12, 1907.

Bridge of Beaufort County, N. C., over Pamlico (Tar) River at Washington.—Plans for rebuilding this bridge were approved November 16, 1907.

Bridge of Pitt County, N. C., over Moccasin River (Contentnia Creek) at Grifton.—Plans and map of location were approved November 26, 1907.

Bridge of the city of Chicago, Ill., over South Branch of Chicago River at Polk street.—Plans and map of location were approved November 26, 1907.

Bridge of Chariton County, Mo., over Grand River at Brunswick.—Plans and map of location were approved November 30, 1907.

Bridge of the Oregon and Washington Railroad Company over Puyallup River near Tacoma, Wash.—Plans and map of location were approved December 21, 1906. Modified plans in lieu thereof were approved December 9, 1907.

Bridge of the Grays Harbor and Puget Sound Railway Company over Chehalis River at Aberdeen, Wash.—Plans and map of location were approved June 20, 1907. Modified plans in lieu thereof were approved December 9, 1907.

Bridge of Duval County, Fla., over Trout Creek, near Jacksonville.—Plans for rebuilding an existing structure were approved December 28, 1907.

Bridge of the Farmer's Warehouse and Bridge Company (Limited) over Clearwater River at Oro Fina, Idaho.—Plans and map of location were approved December 28, 1907.

Bridge of Harbor View Realty Company across Small Creek, an arm of Norwalk Harbor, Conn.—Plans and map of location were approved December 28, 1907.

Bridge of Oregon and Washington Railroad Company over city waterway at Tacoma, Wash.—Plans and map of location were approved December 28, 1907.

Bridge of Fort Bend County, Tex., over Brazos River near Rosenberg.—Plans and map of location were approved February 6, 1908.

Bridge of the Marysville and Arlington Railway Company over Stillaguamish River near Arlington, Wash.—Plans and map of location were approved February 6, 1908.

Bridge of the city of Philadelphia, Pa., over Schuylkill River at Passayunk avenue.—Plans for building this bridge were approved December 21, 1901, and modified plans in lieu thereof were approved February 11, 1908.

Bridge of the city of Seattle, Wash., over the portage between Lakes Union and Washington.—Plans and map of location were approved February 12, 1908.

Bridge of Butte and Glenn counties, Cal., over Sacramento River at Hamilton and Chico.—Plans and map of location were approved February 26, 1908.

Bridge of the Lima and Toledo Traction Company over Swan Creek at Toledo, Ohio.—Plans and map of location were approved March 2, 1908.

Bridge of Gordon County, Ga., over Coosawattee River near Fields Ferry.—Plans and map of location were approved March 3, 1908.

Bridge of Fallon Brothers over Town River at Quincy, Mass.—Plans and map of location were approved March 4, 1908.

Bridge of the Missouri and North Arkansas Railroad Company over White River near Negro Hill, Ark.—Plans and map of location for a bridge to be built at this place under authority of act of Congress approved February 4, 1908, were approved March 13, 1908.

Bridge of the city of Menasha, Wis., over Fox River.—Plans for reconstruction of an existing bridge were approved March 20, 1908.

Bridge of the Pere Marquette Railroad Company over Kalamazoo River at Allegan, Mich.—Plans for reconstruction of an existing structure were approved March 23, 1908.

Bridge of the city of Milwaukee, Wis., over Milwaukee River at East Water and Ferry streets.—Plans for rebuilding an existing structure were approved March 24, 1908.

Bridge of the city of St. Joseph, Mich., over St. Joseph River at Wayne street.—Plans for reconstruction of an existing structure were approved March 24, 1908.

Bridge of the Guyan Bridge Company over Guyandot River at Branchland, W. Va.—Plans and map of location were approved March 31, 1908.

Bridge of the Bridgeport Steeplechase Company over Lewis Gut, Bridgeport Harbor, Connecticut.—Plans and map of location were approved April 16, 1908.

Bridge of the Puget Sound Electric Railway over Puyallup River at Kelly street, Puyallup, Wash.—Plans and map of location were approved April 17, 1908.

Bridge of Beaufort County, S. C., across Whale Branch of Coosaw River at Port Royal Ferry.—Plans and map of location were approved April 21, 1908.

Bridge of Saginaw County, Mich., over Tittabawassee River at Saginaw.—Plans for a bridge at this place to replace an existing structure were approved April 21, 1908.

Bridge of Harris County, Tex., over San Jacinto River near Stafford.—Plans and map of location were approved April 25, 1908.

Bridge of the Yazoo and Mississippi Valley Railroad Company over Boque Phalia near Elizabeth, Miss.—Plans for reconstruction of an existing structure were approved May 20, 1908.

Bridge of the Tampa and Sulphur Springs Traction Company over Hillsboro River at West Ninth street, Tampa, Fla.—Plans and map of location were approved May 22, 1908.

Bridge of Pike County, Ky., over Levisa Fork of Big Sandy River at Pikeville.—Plans and map of location were approved May 27, 1908.

Bridge of Greene County, N. C., over Moccasin River (Contentnia Creek) at Hookerton.—Plans for a bridge to replace an existing structure were approved June 1, 1908.

Bridge of the Columbia and Puget Sound Railroad Company over Black River in King County, Wash.—Plans for a bridge to replace an existing structure at this locality were approved June 5, 1908.

Bridge of the Boston and Albany Railroad Company (New York Central and Hudson River Railroad Company, lessee), over Chelsea Creek at Boston and Chelsea, Mass.—Plans for rebuilding the bridge at this place were approved June 16, 1908.

Bridge of the Georgia and Florida Railway over Altamaha River at Vidalia and Hazlehurst, Ga.—Plans and map of location were approved June 28, 1907, and modified plans were approved June 22, 1908.

Bridge of the city of Boston, Mass., over Chelsea Creek at Boston and Chelsea.—Plans for reconstruction of this bridge were approved June 29, 1908.

Under the provisions of section 18 of the river and harbor act approved March 3, 1899, relating to bridges obstructing navigation, plans for alteration of the following bridge so as to render navigation through or under it reasonably free, easy, and unobstructed, have been examined and approved by the Secretary of War, and the local engineer officer has been furnished a copy of the plans and instrument of approval and charged with supervision of the work of alteration so far as necessary to see that the approved plans are complied with:

Bridge of Monongahela County, W. Va., over Monongahela River at Pleasant street, Morgantown.—Plans for rebuilding an existing structure were approved December 26, 1905. Modified plans in lieu thereof were approved July 11, 1907.

BRIDGES OBSTRUCTING NAVIGATION.

Under the requirements of section 18 of the river and harbor act approved March 3, 1899, the Secretary of War notified the persons, corporations, or associations owning or controlling certain bridges obstructing navigation, after giving them a reasonable opportunity to be heard, to so alter said bridges as to render navigation through or under them reasonably free, easy, and unobstructed, specifying in the notice the alterations required to be made and prescribing a reasonable time in which to make them, as follows:

Bridge of the Central of Georgia Railway Company over Choctawhatchee River near Bellwood, Ala.—Notice dated July 2, 1907, served on the company July 19, 1907. Specified alterations to be completed by December 31, 1908.

Bridge of the Atlantic Coast Line Railroad Company over Trent River near Pollocksville, N. C.—Notice dated July 9, 1907, served on the company July 22, 1907. Specified alterations to be completed nine months from date of service of notice, this time being subsequently extended for a period of sixty days.

Bridge of the International Bridge Company and the Grand Trunk Railway Company over Black Rock Harbor, Niagara River, and Erie Canal at Buffalo, N. Y.—Notices dated July 18, 1907, served on the companies July 24 and 31, 1907, respectively. Specified alterations to be completed on or before March 1, 1910.

Bridge of the town of Newcastle, Me., over Sheepscot River at the mouth of Dyers River, Sheepscot, Me.—Notice dated October 21, 1907,

served on the board of selectmen October 26, 1907. Specified alterations to be completed by March 1, 1908, this time being subsequently extended to July 1, 1908.

Bridge of the Pittsburgh, Cincinnati, Chicago and St. Louis Railway Company over Ohio River at Steubenville, Ohio.—Notice dated December 30, 1907, served on the company January 29, 1908. Specified alterations to be completed within two years from date of service of notice.

Bridge of Grady County, Ga. (Hadley Ferry Bridge), over Ocklockonee River.—Notice dated January 8, 1908, served on the board of county commissioners January 30, 1908. Specified alterations to be completed within one hundred and twenty days from the date of service of notice.

Bridges of Leon and Gadsden counties, Fla. (Fairbanks Ferry Bridge and Stewart Bridge), over Ocklockonee River.—Notices dated January 8, 1908, served on the boards of county commissioners January 23 and January 15, 1908, respectively. Specified alterations to be completed within one hundred and twenty days from date of service of notice.

Bridge of the Georgia, Florida and Alabama Railway Company over Ocklockonee River in Leon and Gadsden counties, Fla.—Notice dated January 8, 1908, served on the company January 27, 1908. Specified alterations to be completed within seven months from date of service of notice.

Bridge of the Atchison and Eastern Bridge Company over Missouri River at Atchison, Kans.—Notice dated February 8, 1908, served on the company February 24, 1908. Specified alterations to be completed on or before one year from date of service of notice for construction of new draw span or four months from date of service of notice for providing a channel through existing draw span.

Bridge of the Jefferson City Bridge and Transit Company over Missouri River at Jefferson City, Mo.—Notice dated February 15, 1908, served on the company February 24, 1908. Specified alterations to be completed on or before six months from date of service of notice.

Bridge of the Marlboro and Society Hill Bridge Company over Great Pedee River near Society Hill, S. C.—Notice dated February 18, 1908, served on the company February 26, 1908. Specified alterations to be completed on or before sixty days from date of service of notice.

Bridge of the Cincinnati and Muskingum Valley Railroad Company over Muskingum River below Dresden, Ohio.—Notice dated April 27, 1908, served on the company June 27, 1908. Specified alterations to be completed on or before fourteen months from date of service of notice.

STRUCTURES OTHER THAN BRIDGES IN THE NAVIGABLE WATERS OF THE UNITED STATES.

Pursuant to the provisions of sections 9 and 10 of the river and harbor act of March 3, 1899, and of certain special acts of Congress, numerous applications for permission to build structures of various kinds other than bridges (such as dams, wharves, dolphins, booms, weirs, etc.) in the navigable waters of the United States have been examined with a view to the protection of navigation interests.

Upon the recommendation of the Chief of Engineers permits have been granted by the Secretary of War for the erection of a number of

such structures, but specific reference is not deemed necessary except in the following cases:

Dam of the Savannah River Power Company in Savannah River at Gregg shoals, S. C., and Ga.—Construction of this dam was authorized by acts of Congress approved June 21, 1906, and February 5, 1907. Plans and map of location were approved August 8, 1907.

Dam of the Capital City Power Company (successor to the Capital City Improvement Company) in Missouri River at Wolf Creek, Montana.—Construction of this dam was authorized by act of Congress of April 15, 1906. Plans and map of location were approved April 14, 1908, this location being in lieu of that at Buck Rapids which was approved August 17, 1906.

Dam of the Keokuk and Hamilton Water Power Company in Mississippi River at Des Moines Rapids, Iowa.—Construction of this dam was authorized by act of Congress approved February 9, 1905. Plans and map of location were approved May 9, 1908.

MISCELLANEOUS.

[Public works not provided for in acts making appropriations for the construction, repair, and preservation of works on rivers and harbors.]

BRIDGES AT WASHINGTON, DISTRICT OF COLUMBIA.

Operations under this head were in the charge of Maj. Spencer Cosby, Corps of Engineers, to May 5, 1908, and in the temporary charge of First Lieut. E. J. Dent from May 5, 1908, to the end of the fiscal year.

1. Repair of the Aqueduct Bridge across Potomac River.—(*a*) *Repair of piers.*—Congress by joint resolution approved July 1, 1902, enacted as follows:

> That the Secretary of War be, and he is hereby, authorized to spend an amount not exceeding three thousand dollars from the balance of appropriations made for the reconstruction of pier number four of the Aqueduct Bridge, District of Columbia, for the purpose of the examination of and immediate temporary repairs to the remaining piers of said bridge in cases of need arising from flood or ice.

The act of Congress approved March 2, 1907, making appropriations for the expenses of the government of the District of Columbia for the fiscal year ending June 30, 1908, contains the following item:

> And the unexpended balance, amounting to about fourteen thousand dollars, of the appropriations for the reconstruction of piers numbered four and five of said bridge is hereby reappropriated and made available for the periodical examination of the remaining piers of the bridge and making of such repairs as may be found necessary.

Examinations of the piers by diver and such minor repairs as were found necessary have been made from time to time.

The last examination, made in December, 1906, and January, 1907, showed that most of the old piers were in need of repairs. The portions of these piers below water, with the exception of pier No. 1, the reconstruction of which was otherwise provided for, were repaired during April and May, 1907, and left in as good condition as practicable.

The portions above water were pointed up wherever necessary during September and October, 1907.

July 1, 1907, balance unexpended	$15,053.37
June 30, 1908, amount expended during fiscal year	97.36
July 1, 1908, balance unexpended	14,956.01

(*b*) *Pier No. 1.*—The District of Columbia appropriation act approved March 2, 1907, contains the following item:

AQUEDUCT BRIDGE: For reconstruction of pier numbered one of the Aqueduct Bridge across the Potomac River at Georgetown, District of Columbia, to be expended under the direction of the Secretary of War, eighty thousand dollars.

An examination made in January, 1907, showed this pier to be in such condition that it was considered impracticable to repair it satisfactorily.

Plans and specifications for the complete removal of the pier and the construction of a new and stronger pier in its place were prepared and a contract for the work was entered into July 24, 1907. Work under the contract was begun August 15, when dredging around the pier was started. From about the first of September the work was carried on continuously, except for delays due to freshets and ice in the river during January and February, 1908, and to shortage of materials at other times. The cofferdam and the false work to support the superstructure of the bridge were finally completed in March and the removal of the old pier was begun. This work was completed and the construction of the new pier commenced late in April. The new pier is founded on the solid rock bottom of the river and consists of a concrete base extending to about 7 feet below the water line and of ashlar masonry with concrete backing above that elevation.

The masonry work is completed with the exception of a few minor items, such as pointing up, cleaning, etc.

July 1, 1907, balance unexpended	$80,000.00
June 30, 1908, amount expended during fiscal year	25,199.72
July 1, 1908, balance unexpended	54,800.28
July 1, 1908, outstanding liabilities	274.58
July 1, 1908, balance available	54,525.70
July 1, 1908, amount covered by uncompleted contracts	41,080.33

(See Appendix E E E 1.)

2. Highway bridge across Potomac River at Washington, D. C.—(*a*) *Construction.*—Section 12 of the act of Congress approved February 12, 1901, provides for the construction of a highway bridge to replace the existing Long Bridge, and appropriated the sum of $568,000 for the purpose. The date for completion called for by this act was February 12, 1903.

By various subsequent acts and joint resolutions the time for completion was extended to June 30, 1907. The limit of cost was increased to $996,000 by the act of July 1, 1902, and by the act of April 27, 1904, the limit of cost of the bridge and approaches was increased to $1,196,000, and the increased sum was appropriated.

Bids for the construction of the bridge across the main river were opened first on March 27, 1903, and all being in excess of the amount available were rejected.

As a result of the second bidding of July 25, 1903, on slightly revised plans and specifications, a contract was entered into on August 29, 1903, for the erection of the bridge, and construction work was commenced in October, 1903.

Considerable delay was caused by the unusually severe winters of 1903–4 and 1904–5. It was found impossible to complete the bridge by the original time specified; the time limit of the contract was

accordingly waived and the bridge proper was finally completed February 7, 1906.

The approach on the Washington side includes a reenforced concrete bridge across the Washington channel. Construction work on this was commenced in the fall of 1905 and it was opened to vehicular traffic June 27, 1907.

Descriptions of both bridges will be found in the Annual Report for 1906.

The earth embankments for the approaches to the main bridge were constructed chiefly during the summer and fall of 1905. A temporary macadam roadway was laid on them first, as it was considered inadvisable to place permanent paving on the new fills.

A permanent concrete pavement was laid over the macadam in the fall of 1906 and at the same time sidewalks and concrete curbs were built.

A macadam roadway for the use of light vehicles and automobiles was built alongside the concrete roadway on the Virginia approach during the summer of 1907.

The embankments of the short approaches to the Washington Channel Bridge were constructed during the summer of 1907 and the permanent concrete pavement was laid directly on the new fills.

Shade trees have been set out along both approaches to the main bridge. The slopes of the Washington approach have been sodded and those of the Virginia approach have been planted with honeysuckle.

On the Washington approach drainage and electric lighting systems have been installed and conduits laid for telegraph, telephone, light, and power cables.

A standard underground conduit electric railway system has been installed by the Washington, Alexandria and Mt. Vernon Railway Company from the foot of 14th street to the plow pits about 270 feet from the north end of the bridge. From the plow pits to the north end of the bridge an overhead-trolley system with ground return is in use and legislation authorizing the permanent retention of this system is pending before Congress.

All of the work in connection with the construction of the highway bridge and approaches has been completed.

July 1, 1907, balance unexpended	$32,353.04
June 30, 1908, amount expended during fiscal year	27,520.80
July 1, 1908, balance unexpended	4,832.24
July 1, 1908, outstanding liabilities	300.60
July 1, 1908, balance available	4,531.64
July 1, 1908, amount covered by uncompleted contracts	4,407.14

(*b*) *Maintenance and operation.*—The District of Columbia appropriation act, approved March 2, 1907, contains the following item:

Highway bridge across Potomac River: For salaries of two draw operators, at one thousand and twenty dollars each; three watchmen, at six hundred dollars each; for labor, one thousand five hundred dollars; and for lighting, power, and miscellaneous supplies, and expenses of every kind necessarily incident to the operation and maintenance of the bridge and approaches, ten thousand six hundred and sixty dollars; in all, sixteen thousand dollars.

This appropriation has been applied to the payment of salaries of *draw operators, watchmen*, and laborers, to superintendence and in-

spection when necessary, to providing current for operating the draw and for lighting the bridge and Washington approach, to lighting the Washington Channel bridge with high candle power incandescent gas lamps, and to repairs, telephone service, purchase of tools, supplies, etc.

An estimate of $16,000 for the payment of expenses incident to operation and maintenance of the bridge and approaches during the fiscal year ending June 30, 1910, is herewith submitted in detail, as required by act of Congress approved June 27, 1906 (District of Columbia appropriation act).

ESTIMATE OF COST OF MAINTENANCE AND OPERATION FOR FISCAL YEAR ENDING JUNE 30, 1910.

Salaries:	
2 draw operators, at $1,020 each	$2,040
1 draw operator, at $720	720
4 watchmen, at $600 each	2,400
Labor (regular) for cleaning roadway, etc	1,500
	6,660
Current for operating 6,000 openings, at 9 cents	540
Lighting 48 arc lamps, at $85	4,080
Lighting 20 gas burners, at $20.85	417
Telephone service	63
Fuel for heating operating house	65
Miscellaneous supplies, grease, waste, oil, etc	375
Painting and repairs	2,500
Contingencies (additional labor, etc.)	700
Superintendence and office expense	600
Total	16,000

MAINTENANCE OF HIGHWAY BRIDGE ACROSS POTOMAC RIVER, DISTRICT OF COLUMBIA, 1907.

July 1, 1907, balance unexpended	$1,673.10
June 30, 1908, amount expended during fiscal year	1,551.80
July 1, 1908, balance unexpended, reverted to Treasury	121.30

MAINTENANCE OF HIGHWAY BRIDGE ACROSS POTOMAC RIVER, DISTRICT OF COLUMBIA, 1908.

Amount appropriated by act of March 2, 1907	$16,000.00
June 30, 1908, amount expended during fiscal year	13,947.33
July 1, 1908, balance unexpended	2,052.67
July 1, 1908, outstanding liabilities	1,146.65
July 1, 1908, balance available	906.02
July 1, 1908, amount covered by uncompleted contracts	901.68

(See Appendix E E E 2.)

MAINTENANCE AND REPAIR OF THE WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, AND WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, FILTRATION PLANT.

Operations under this head were in the charge of Maj. Spencer Cosby, Corps of Engineers, to May 5, 1908, having under his immediate orders First Lieut. E. J. Dent, Corps of Engineers, and in the temporary charge of Lieutenant Dent from May 5, 1908, to the end of the fiscal year.

1. Washington Aqueduct, District of Columbia: (A) Maintenance and operation of the Washington Aqueduct and its accessories.—Appropriations for maintenance and operation of the Washington Aqueduct are applied to the improvement, maintenance, and repair of those parts of the water-supply system which are under the supervision of the Chief of Engineers. These are the masonry dam across the Potomac at Great Falls, the works there for regulating the supply to the conduit, the Conduit road from Great Falls to Washington, a distance of about 14 miles, the conduit from Great Falls to the Georgetown reservoir, a distance of about 12 miles, the three reservoirs for supplying the city, the tunnel, about 4 miles long, connecting the Georgetown and McMillan Park reservoirs, the two bridges for carrying the mains across Rock Creek, and other auxiliary works. A description of these works may be found in the Annual Report of the Chief of Engineers, 1903, pages 2485–2487.

The original project for construction of the Washington Aqueduct was dated February 12, 1853, and published as Senate Executive Document No. 48, Thirty-second Congress, second session. The project provided for supplying the city of Washington with water taken from the Potomac River at Great Falls, Maryland, about 14 miles above the city and 16½ miles from the present filtration plant, and with water from Little Falls Branch. Work was begun in 1853, and in 1859 water from Little Falls Branch was supplied to the city through the conduit. The first Potomac water was supplied to the city in December, 1863.

The water from Little Falls Branch became polluted and works for excluding it were completed in 1895. The dam at Great Falls was raised during 1896 and the capacity of the system increased to its present extreme limit of 95,000,000 gallons per day, or, making allowances for sudden increases in consumption, to a safe limit of 65,000,000 gallons. For a discussion of the capacity of the system, see Annual Reports, Chief of Engineers, for 1897, pages 3991–4014, and for 1906, pages 2093–2095.

During the year the feeder at Great Falls was cleaned twice; the tunnel between Georgetown and McMillan Park reservoirs was partially pumped out, inspected, cleaned, and repaired.

Some repairs were made to the Conduit road; a new floor was laid on the Pennsylvania Avenue Bridge across Rock Creek; the laborer's house at Dalecarlia reservoir was remodeled; about 3,900 linear feet of the old wooden fence around the Georgetown reservoir were removed and replaced by a woven-wire fence; about 700 cubic yards of broken stone were placed on the Conduit road between the club house and Glen Echo, and all buildings, grounds, and other structures were maintained in good order and condition.

The practice of closing the gates at Great Falls during periods of high turbidity was continued with good results.

Attention is invited to that portion of the report of the officer in charge which deals with the subject of consumption and waste of water. The present system can not safely supply a greater quantity of water than is now taken from it, and the recommendations in regard to metering all Federal buildings and institutions are concurred in.

WASHINGTON AQUEDUCT, D. C., 1907.

July 1, 1907, balance unexpended	$3,725.12
June 30, 1908, amount expended during fiscal year	3,697.21
July 1, 1908, balance unexpended	[a] 27.91

WASHINGTON AQUEDUCT, D. C., 1908, MAINTENANCE.

June 30, 1908, amount expended during fiscal year	$29,405.50
July 1, 1908, balance unexpended	3,624.79
July 1, 1908, outstanding liabilities	3,579.83
July 1, 1908, balance available	44.96

(*B*) *Purchase of dredge for Dalecarlia Reservoir.*—By act of Congress approved March 2, 1907, $30,000 was appropriated for purchase of a dredge for removing sediment from Dalecarlia Reservoir.

Proposals for furnishing a 10-inch hydraulic dredge were opened June 13, 1907, and the contract was awarded to the Wetherill Brothers Machine Company, of Chester, Pa., at a cost of $26,400. Work was begun on the dredge immediately, it was completed in January, 1908. and finally accepted on April 13, 1908. For a brief description of the dredge see report of the officer in charge, Appendix F F F, page 2359.

June 30, 1908, amount expended during fiscal year	$27,893.90
July 1, 1908, balance unexpended	2,106.10
July 1, 1908, balance available	2,106.10

(*C*) *Dredging Dalecarlia Reservoir.*—By act of Congress approved March 2, 1907, an appropriation of $16,000 was made for removal, by dredging, of about 134,000 cubic yards of sediment from Dalecarlia Reservoir.

Dalecarlia Reservoir was formed by constructing a dam across a natural valley. Until the year 1893 the streams flowing down that valley emptied into the reservoir, and at the present time the arms of the reservoir where the streams entered show a considerable deposit made by them. These streams are now carried around the reservoir by means of a drainage canal and tunnels, completed in 1895. In addition to the deposits made in this way, there are annually deposited several thousand cubic yards of fine mud brought by the Potomac water from Great Falls through the Washington Aqueduct.

The reservoir was completed in the year 1859, and has never been thoroughly cleaned since. As the water from the conduit enters the reservoir the coarser particles are rapidly deposited, due to the sudden check in the velocity of flow, and a bar is formed across the upper end of the reservoir, which has at times seriously obstructed the flow of water. This happened in February, 1905, when, in order to maintain the supply of water to the city, it was necessary to open the by-conduit around the reservoir. By the use of wheelbarrows and an extemporized dredge a channel was excavated through the bar and the situation was temporarily relieved.

Work under the appropriation for dredging was necessarily delayed until the completion of the dredge, referred to in section B. Dredging was begun during January, 1908, and was continued from

[a] Balance of $27.91 deposited in United States Treasury (reverted and dropped).

that date to the close of the fiscal year, with the exception of minor delays due to accidents, etc. It is now estimated that the total amount of material to be removed by dredging is 160,000 cubic yards. The amount removed to the close of the present fiscal year was 46,380 cubic yards.

As all of the dredging necessary could not be completed during the fiscal year 1908, Congress, by act approved May 26, 1908, provided that any unexpended balance under the appropriation for dredging should continue to be available for the fiscal year 1909.

June 30, 1908, amount expended during fiscal year	$4,485.08
July 1, 1908, balance unexpended	11,514.92
July 1, 1908, outstanding liabilities	642.83
July 1, 1908, balance available	10,872.09

(*D*) *Riprapping shore of Dalecarlia Reservoir to protect the by-conduit.*—By act of Congress approved March 2, 1907, $2,000 was appropriated for the above purpose.

The Dalecarlia Reservoir was formed by the construction of an eastern dam across a natural valley. A portion of the by-conduit lies in this dam. While the reservoir is provided with a drain, only one attempt to drain it has ever been made, and on that occasion a serious break in the by-conduit occurred at about the junction between the natural ground and the earthern dam. The by-conduit was repaired but not materially strengthened, and prior to the work done during the fiscal year 1908 it was not considered safe to drain the reservoir while supplying the city through the by-conduit.

With the money available the earth fill between the by-conduit and the reservoir was strengthened and protected by riprap. All work was done by day labor and was completed during December, 1907.

June 30, 1908, amount expended during fiscal year	$2,000.00

(*E*) *Riprapping sides of Dalecarlia Reservoir.*—By act of Congress approved March 2, 1907, $18,000 was appropriated for riprapping the sides of Dalecarlia Reservoir for a width of about 20 feet.

Before this work was begun the shore line of the reservoir was irregular and the slopes of the bottom, near the shore line, were so slight that when the water was low large areas of mud flats were exposed, and during windy-weather mud was stirred up by the waves, materially increasing the turbidity of the water.

Work was begun in July, 1907, and was continued until December 31, 1907. About 3,806 cubic yards of rock were quarried, and 6,886 linear feet of the shore line were graded and protected by riprap.

There are 4,386 linear feet of shore line remaining to be paved, and as this work could not be done until the completion of a large proportion of the dredging described in section C, Congress, by act approved May 26, 1908, provided that any unexpended balance under the appropriation for riprapping should continue to be available for the fiscal year 1909.

June 30, 1908, amount expended during fiscal year	$13,109.31
July 1, 1908, balance unexpended	4,890.69
July 1, 1908, balance available	4,890.69

(*F*) *Parking grounds, Washington City Reservoir.*—By act of Congress approved March 2, 1907, the sum of $3,000 was appropriated for parking the grounds at the Washington City Reservoir (now known as McMillan Park Reservoir). Prior to June 30, 1907, the top of the dam south of the reservoir had never been graded and was in a rough and unsightly condition. During the fiscal year 1908 this area was graded, seeded, drained, and trees were set out; a topographical survey was made of the entire area known as McMillan Park, and a map is being prepared which will be used as a basis for future improvements.

June 30, 1908, amount expended during fiscal year	$2,726.21
July 1, 1908, balance unexpended	273.79
July 1, 1908, outstanding liabilities	273.79

The estimates for the fiscal year ending June 30, 1910, are as follows:

For operation, including salaries of all necessary employees, maintenance and repair of the Washington Aqueduct and its accessories, including the Conduit road, the McMillan Park Reservoir, and the Washington Aqueduct tunnel, and also including the purchase and maintenance of horses, vehicles, and harness, and the care and maintenance of the stable	$33,000
For construction of a dwelling for an assistant watchman at Great Falls, Md	3,000
For construction of a combined storehouse and stable at Great Falls, Md	3,000
For emergency fund, to be used only in case of a serious break requiring immediate repair in one of the important aqueduct or filtration plant structures, such as a dam, conduit, tunnel, bridge, building, or important piece of machinery, all expenditures from this appropriation to be reported in detail to Congress	5,000

(See Appendix F F F 1.)

2. *Washington Aqueduct, District of Columbia, filtration plant:* (*A*) *Construction.*—By act of Congress approved June 6, 1900, the sum of $2,000,000 was appropriated—

> For establishing those portions of a filtration plant which are essential to the operation of either system of filtration adopted * * *.

By act of Congress approved March 1, 1901, the sum of $500,000 was appropriated—

> Toward establishing a slow filtration plant * * *.

By these and subsequent acts of Congress there has been appropriated for this work a total sum of $3,468,405.

A description of the Washington Filtration Plant is given on pages 2101 to 2103, Annual Report of the Chief of Engineers, U. S. Army, 1906.

At the beginning of the fiscal year the work had been practically completed. During the fiscal year 1908 a machine-shop building was erected by contract; an experimental filter unit was added to the plant at Dalecarlia Reservoir, and some gratings were made and placed over the wells in the regulator houses.

No contract is now in force except the one with Henry R. Worthington for the main pumping engines. While the work under this contract was completed in August, 1907, the final payment will not be due until August 3, 1908.

The necessity for completing the plant by the construction of works for preliminary treatment of the water is discussed by the officer in charge under the head of "Maintenance and operation," and the following estimate for the proposed work is submitted:

For remodeling the Georgetown Reservoir and constructing works to provide for the preliminary treatment of Potomac water by means of a coagulant, and for each and every purpose connected therewith, $90,000, to be available until expended, and the unexpended balances of the amounts heretofore appropriated by Congress for a slow-sand filtration plant are also hereby made available for the above purpose.

July 1, 1907, balance unexpended	$67,913.79
June 30, 1908, amount expended during fiscal year	13,923.06
July 1, 1908, balance unexpended	53,990.73
July 1, 1908, outstanding liabilities	4,494.67
July 1, 1908, balance available	49,496.06

3. Washington Aqueduct, District of Columbia, filtration plant: (B) Maintenance and operation.—By act of Congress approved March 2, 1907, the sum of $90,000 was appropriated for maintenance and operation of the Washington Aqueduct, District of Columbia, Filtration Plant for the fiscal year 1908.

The Washington Filtration Plant consists of a pumping station for raising the water from the McMillan Park Reservoir to the filters; of 29 filter beds of the slow-sand type, having an effective filter area of 1 acre each; of a filtered water reservoir, having a capacity of about 15,000,000 gallons; of the necessary piping and valves for carrying the water, controlling the rates of filtration, etc.; of a sand washing and storage system, and of a laboratory for testing the water. The filtration plant has been in continuous operation throughout the year and the entire water supply of the city has been filtered. The bacteria have been reduced from an average of 1,252 per cubic centimeter in the McMillan Park Reservoir to an average of 55 in the filtered water reservoir. The average turbidity has been similarly reduced from 31 to 2 parts per million. The actual number of bacteria in the city water varied from 900 to 4 per cubic centimeter, while the number in the river water ran from 80,000 to 16. The actual average reduction by months varied between 99.7 and 98 per cent.

The work during the year consisted in cleaning and operating the filters; in analyzing samples of water from the several reservoirs, from each filter, and from taps in various parts of the city; in operating and keeping in repair the pumping station; in doing the necessary clerical work connected with the office, and in conducting experiments with a view to determining the best method for obtaining at all times a satisfactory effluent with respect to both bacteria and turbidity. All work was done by day labor.

The total quantity of water pumped to the filters during the year was 23,758.24 million gallons, or an average of 64.91 million gallons per day. During the year 22,275 cubic yards of sand were washed and 21,393 cubic yards were replaced in the filters. While the quality of the city filtered water was excellent for the greater part of the year, there were several periods when the number of bacteria exceeded what is considered by experts to be the proper standard for a

filtered water supply. The filtered water was unsatisfactory with respect to turbidity for a considerable percentage of the time. This confirms the experience of the two previous fiscal years and also the judgment of the three experts as expressed in their report, dated February 18, 1901, to the chairman Senate Committee on the District of Columbia.

The cost per million gallons filtered was $3.13.

A more complete description of the Washington Filtration Plant may be seen in the Annual Report of the Chief of Engineers for 1906, pages 2101 and 2102.

Attention is invited to that portion of the report of the officer in charge which deals with the subject of preliminary treatment of Potomac water. A year of elaborate experimentation has shown conclusively that the water can be materially improved by the use of preliminary coagulation during periods of high turbidity and high bacterial counts. It has also been shown that the methods of preliminary filtration used at Philadelphia and elsewhere will not give satisfactory results when applied to Potomac water.

In the closing paragraph of the report of the committee of experts referred to above, they recommended—

> The construction of a complete system of slow or sand filters, with such auxiliary works as may be necessary for preliminary sedimentation, and the use of a coagulant for a part of the time.

This report was submitted in 1901 and subsequent experience has confirmed the wisdom of their recommendation. The opinion as to the necessity for coagulation (see Annual Report of the Chief of Engineers, 1906, pages 2099–2100) expressed by Mr. Allen Hazen, who was employed as consulting engineer in the construction of the filtration plant, has also been substantiated by the experiments conducted here.

In order that the city of Washington may at all times be supplied with a water that is unexceptional both in quality and appearance, it is recommended that works for preliminary coagulation be constructed, and estimates for this improvement are submitted.

The following estimate of the cost of maintenance and operation of the Washington Aqueduct, District of Columbia, Filtration Plant, for the year ending June 30, 1910, is submitted:

1 superintendent	$3,000
1 chief chemist and assistant superintendent	2,100
1 first assistant chemist	1,500
1 second assistant chemist	1,000
1 stenographer and clerk	1,200
2 janitors, at $600 each	1,200
1 chief steam engineer	1,800
1 first assistant steam engineer	1,440
1 second assistant steam engineer	1,080
1 machinist	1,140
1 blacksmith, at $3.50 per day, 300 days	1,050
3 oilers, at $900 each	2,700
3 firemen, at $900 each	2,700
3 laborers, at $540 each	1,620
1 filter foreman	1,400
1 surveyor	1,200
2 foremen, at $900 each	1,800
1 timekeeper	900
3 watchmen and gauge tenders, at $900 each	2,700
1 storekeeper	900

5 skilled laborers, at $600 each	$3,000
1 recorder	720
40 laborers, at $1.50 per day, for 300 days	18,000
5 teams with drivers, at $2.25 per day, for 200 days	2,250
Laboratory and office supplies	800
3,800 tons of coal, at $3.80	14,440
Pumping station supplies, oils, waste, packing, repairs, etc	7,000
Filter supplies, tools, hose, and repairs	8,000
Total	86,640
For purchase of coagulant	9,000
Grand total	95,640

MAINTENANCE, WASHINGTON AQUEDUCT, D. C., FILTRATION PLANT, 1907.

July 1, 1907, balance unexpended	$9,166.72
June 30, 1908, amount expended during fiscal year	7,991.39
July 1, 1908, balance unexpended	[a] 1,175.33

MAINTENANCE, WASHINGTON AQUEDUCT, D. C., FILTRATION PLANT, 1908.

June 30, 1908, amount expended during fiscal year	$72,630.66
July 1, 1908, balance unexpended	17,369.34
July 1, 1908, outstanding liabilities	6,093.42
July 1, 1908, balance available	11,275.92
July 1, 1908, amount covered by uncompleted contracts	3,654.68

(See Appendix F F F 2.)

IMPROVEMENT AND CARE OF PUBLIC BUILDINGS AND GROUNDS, AND CARE AND MAINTENANCE OF THE WASHINGTON MONUMENT, IN THE DISTRICT OF COLUMBIA.

Officer in charge, Col. Chas. S. Bromwell, U. S. Army.

Repairs and betterments were made about the Executive Mansion. Considerable painting done in the interior and the work of painting the exterior of the main building and its east and west wings, which was commenced in June, 1907, completed early in the fiscal year. A second new water-tight covering placed upon the roof of the east terrace in place of that placed thereon during the summer of 1906, and which proved defective, the second covering being placed at the expense of the contractor. The exterior of the Executive Office building painted. Considerable repairing done at the President's stables and repairs made to the greenhouse structures and to their boilers and heating pipes.

Necessary carpentry, painting, plumbing, and heating repairs made to house No. 516 Tenth street NW., where Abraham Lincoln died.

The Sixth street station building transferred to the War Department by the Pennsylvania Railroad Company, placed in charge of the office of public buildings and grounds, a contract entered into

[a] Balance of $1,175.33 deposited in United States Treasury January 23, 1908 (reverted and dropped).

July 9, 1908, for its removal, and the sum of $1,315 received from the contractor for the old materials contained in the structure.

At the Washington National Monument new cast-iron sheaves placed at top for cables and new governor gears and shaft put in place on cable drum of elevator. Miscellaneous repairs made about the shaft, the power house, and lodge house.

Inspection made each month of the buildings occupied as offices by the War Department, except the State, War, and Navy Department building, so far as their care, safety, and preservation were concerned.

The care required to maintain them in good condition extended to the improved parks and places. Two additional park spaces transferred to the Chief of Engineers by the Commissioners of the District of Columbia. Five unimproved reservations improved. The riverside drive in sections 1 and 2 of Potomac Park completed by the construction of the portion of it between the drainage canal and the foot of Twenty-sixth street NW. The work of improving East Potomac Park between the river, the Pennsylvania Railroad causeway, and the tidal reservoir completed. The direction of the south end of the waterside drive in Monument grounds annex changed so as to bring it out at Fourteenth street, opposite Water street. Cement coping constructed around 7 reservations, a total of 2,072 feet of coping and 11 corner posts. Over 11,000 square yards of gravel roadway in the President's Park surfaced with broken trap rock. The boathouse on the shore at the northeast corner of the tidal reservoir transferred by the Commissioners of the District of Columbia to the Chief of Engineers. Garfield Park remodeled by turning abandoned roadways into lawn surfaces and extending walks out to sidewalk lines. The main asphalt roadway running east and west through Smithsonian grounds resurfaced with asphalt over an area of 4,830 square yards. Six hundred sixty-three square yards of new asphalt walk constructed and 1,310 square yards of old asphalt walk and 140 square yards of asphalt roadway repaired. Six hundred park settees painted and 214 repaired. Ten additional electric lights and 6 additional gas lamps erected, some of the park lodges and tool houses painted, 8,737 feet of water pipe and 2,566 feet of drain pipe laid, and 2,422 feet of brick gutters and 43 brick catch basins constructed.

At the propagating gardens the various greenhouses repaired as far as funds would permit. Nearly 900,000 plants were propagated for planting in parks and 329 trees and 1,060 shrubs planted in various portions of the public grounds.

The foundation for the Grant statue nearly completed, a contract entered into for the Sheridan statue, the clay model of the statue completed in readiness to be cast in bronze. A contract entered into for the Pulaski statue, progress made with the models for Von Steuben statue, the full-size model of Kosciuszko statue completed. A site and a sculptor selected for the John Paul Jones statue, and a site selected for the statue of Commodore Barry, and a program of competition prepared. A site selected for the statue of Longfellow and a contract entered into for the erection of its pedestal. An architectural design accepted for the memorial to Christopher Columbus, invitations sent out for a competition for the sculpture, and a site selected. A design approved for the Stephenson Grand

Army memorial, a site selected and a contract entered into for the pedestal. A site selected for a statue of John Witherspoon.

Necessary repairs made to the departmental telegraph line.

The grounds and roadways at the monument at birthplace of Washington cleaned up and fences repaired.

Attention is invited to the detailed report of the officer in charge and to his estimates and recommendations for the fiscal year ending June 30, 1910.

The estimates are as follows:

For the improvement and care of public buildings and grounds in charge of the Chief of Engineers		$294,870
For compensation of persons employed by Office of Public Buildings and Grounds		84,670
Telegraph lines connecting Capitol with Departments: Care and repair of existing lines and placing overhead lines underground		4,500
For contingent and incidental expenses of public buildings and grounds		1,000
For care of Washington Monument and maintenance of elevator:		
Salaries of employees	$8,820	
Fuel, lights, contingencies, etc	3,000	
		11,820
For monument and wharf at Wakefield, Va., the birthplace of Washington: Repairs to wharf and cleaning up grounds, etc		7,100
		403,960

(See Appendix G G G.)

NORTHERN AND NORTHWESTERN LAKES—CORRECTING AND ISSUING CHARTS — SURVEYS — WATER LEVELS — PRESERVATION OF NIAGARA FALLS.

As early as 1816 local surveys of the Great Lakes for special purposes were made by engineer officers, but the " Lake Survey " as a systematic work was commenced in 1841. It was diligently prosecuted thereafter until 1882, when for a time extended field operations were suspended. The correction, printing, sale, and issue of charts continued without cessation, however, the additions and corrections being largely based upon local surveys and reports by engineer officers in charge of the river and harbor improvements on the lakes.

Systematic field work was resumed in 1889, and has since been prosecuted with increased vigor. In 1898 operations were extended to include cognate work of observing and investigating the levels of the Great Lakes and their connecting waters, with a view to their regulation in the interest of commerce. The survey proper has from the beginning been carried on under the War Department, being at first conducted by the Chief of Topographical Engineers, and by the Chief of Engineers after the consolidation of the Topographical Engineers with the Corps of Engineers.

The first regular appropriation for the Lake Survey was made in 1841, and annual appropriations followed with the single exception of 1847. The appropriations to date for all purposes of the Survey during the sixty-seven years of its existence aggregate $4,186,879, of which $2,411.81 has reverted to the Treasury.

A full account of the operations of the Lake Survey from May, 1841, to July 1, 1881, is contained in Professional Papers, Corps of Engineers, U. S. Army, No. 24, which describes in detail the methods

of primary triangulation employed. The condition of lake navigation in 1841 is shown by the following extract:

The Lake Survey was begun in 1841 under an appropriation of $15,000 made in May of that year. At this time the country bordering on the lower lakes was already pretty well settled, and works for the improvement or formation of harbors had been commenced at most of the important points on Lakes Erie and Ontario. The upper lake region was but thinly settled, and there were no good harbors on Lake Huron and but one (the harbor of Chicago) on Lake Michigan. Settlers were, however, pouring in rapidly, and there was even then a large and constantly increasing commerce between the lake ports, especially from Buffalo to Detroit and Chicago. Communication with Lake Superior could only be had by portage around the Sault Ste. Marie, but the great mineral wealth of the country was attracting attention, and a survey for a ship canal had been made in 1840 by officers of the Topographical Engineers. The lake commerce was carried on under many difficulties, which caused much loss of life and property each year.

There were no charts of the lakes except the Admiralty charts, compiled from the surveys of Capt. H. W. Bayfield, of the royal navy (English), and these were not in general use by the masters of American vessels. These charts were the results of rapid reconnaissances, and although they showed the coast lines with an accuracy which is remarkable considering the rough methods of surveying employed, they were of little value as hydrographical charts of the American coast, because they showed the depths of water in comparatively few places and but a small number of the many reefs and shoals which are found along the lake shores.

There were few light-houses and beacons to indicate the positions of dangers to navigation, and, in the absence of charts, pilots were obliged to rely upon their own knowledge, which was frequently only acquired by the vessels grounding on a shoal or striking a hidden rock.

The navigation of the lakes is attended with peculiar dangers, because, while violent gales are frequent and the storms rival those of the ocean itself, a vessel is never more than a few hours' run from the shore and can not, as is generally the case at sea, drift before the wind until the storm is over, but in a long-continued gale must be thrown upon the shore, unless a port or harbor of refuge can be entered. In 1841 a vessel leaving Chicago found no harbor or shelter in storms until the Manitou or Beaver islands were reached, and after passing the Straits of Mackinac it was again exposed without refuge on Lake Huron, except in the vicinity of Presque Isle, until the head of St. Clair River was reached. In sailing from Chicago to Buffalo the greatest difficulties were encountered in the vicinity of the Straits of Mackinac and in the west end of Lake Erie on account of the many islands, shoals, and reefs found in those localities, and at the mouth of the St. Clair River, at which no improvements had been made in 1841, and where the channels were not only circuitous and narrow, but so shoal that vessels in low-water seasons frequently were compelled to have their cargoes taken over the bars in lighters.

It was therefore with the double object of furnishing reliable charts to lake vessels and of determining from the surveys the works of improvement which were necessary to the prosperity of the lake commerce that Congress in 1841 directed a survey of the lakes, and that annual appropriations, with the single exception of the year 1847, have since been made for carrying on the survey.

During the first ten years of the Survey, while a general geodetic survey of the entire chain of lakes was contemplated for the future, the actual operations were mainly confined to surveys of special localities where improvements were called for or where the navigation was difficult; and where the surveys were more extended they were little more than reconnaissances. This course was made necessary because the appropriations were inadequate to the purchase of the finer instruments and the support of the larger force necessary for more extensive and more exact surveys, and also because of the pressing need of improvements at particular localities, for which preliminary surveys were essential.

Originally the Lake Survey seems to have operated under projects which implied the survey of the Great Lakes and their connecting waters to the extent necessary for the preparation of charts needed by a navigation whose greatest draft was 12 feet. With the increase

in vessel dimensions has naturally followed the creation of channels and harbors with progressively greater depths, and the Lake Survey, under projects providing for the expenditure of annual appropriations, has kept pace with the improvements in navigation and in navigational facilities by a corresponding extension of the scope of its operations.

It is difficult to indicate the exact moment of transition from the original projects which, as stated, provided for surveys and their resulting charts adapted to a 12-foot navigation, to the recent projects which correspond to present-day drafts of 18 to 20 feet; but, in a general way, it may be said that the limitations imposed upon navigation by the conditions at the falls of the St. Marys River have seemed to fix the scope of the operations of the Lake Survey in the open lakes and in the connecting rivers, while local projects for improvement have prescribed the limits of the survey work in lake harbors. The work of the Lake Survey has been continuous, and while a general project for the future work has now been authorized, all expenditures upon work done before the adoption of this project may justly be regarded as contributing to its fulfillment. In other words, none of the work of the past has been rendered futile by the changed conditions of the present. On the contrary, the methods of the old Lake Survey, and the high standards of accuracy and excellence which then prevailed, have continued to characterize its present policy and operations; and the work of to-day extends the former work to limits which were not anticipated by the most sanguine spirits of former days.

The present general project of the Lake Survey is stated in much detail in the Annual Report for 1907, pages 844 to 850. This describes the work regarded as necessary in order to render the surveys and the charts of the Lake Survey adequate to respond to all possible future demands. This general project proposes the ascertainment and charting of lake depths in all significant regions of the Great Lakes to a plane 30 feet below the adopted low-water datum of the open lakes and 25 feet below the corresponding datum in the channels of the connecting rivers, together with the completion of the related operations of triangulation and precise leveling still needed to control properly the areas under survey. In addition, this general project provides for the extension of river-discharge measurements, for investigations of lake levels, and for magnetic surveys in and near main vessel courses, while prompt examination of areas where obstructions to navigation have been reported will be continued as heretofore.

Assuming that adequate appropriations will be provided, it is estimated that the completion of the above general project will, including the work of 1908, require eleven seasons' work; but, even after the completion of this work, the maintenance of a reduced plant and organization will be required for such small surveys as may be needed to observe and verify natural changes and to investigate wrecks and other artificial obstructions, while the revision and issue of charts is a work absolutely without definite conclusion.

The amount expended on all surveys made since its inception by the Lake Survey may with propriety be regarded as the expenditure under the present project. As previously stated, this amount is *$4,186,879.*

Assuming that the field work of the Lake Survey includes operations of triangulation, precise leveling, ordinary sounding, deep-sea sounding, sweeping, hydraulic measurement, and magnetic observations, whose extent may with some certainty be fixed, on June 30, 1908, the state of the work was as follows: Triangulation was 74 per cent completed; precise leveling, 63 per cent completed; ordinary sounding, 48 per cent; deep-sea sounding, 15 per cent; sweeping, 6 per cent; hydraulic measurement, 75 per cent, and magnetic observations, 90 per cent completed on land and 2 per cent on water.

While these figures may be definitely given, the remaining and most highly important function of the Lake Survey, namely, the issue of charts, as previously stated, is absolutely without termination. In fact, each year, with its increasing commerce, will increase the demand for and the importance of these charts.

During the early months of the present fiscal year, due to lack of funds for more extensive operations, but three parties were in the field, as follows: One party in the west end of Lake Erie, south and east of Colchester light, with a view to extending and widening, by sweeping, the belt over which precise depths have been fixed. While this portion of Lake Erie is much disturbed by winds and storms, this party, from July 1 to November 2, 1907, covered an area of 77 square miles, of which 62 square miles were swept. In all, 2 hitherto uncharted shoals were discovered and 3 unknown or incorrectly located wrecks were found and examined. To complete the general project 498 square miles of water area still remain to be surveyed at this end of Lake Erie.

The second party was engaged in the Straits of Mackinac, extending the projected work from Manitou Paymen shoal to the eastward with a view to covering an area where repeated, but unverified reports showed that uncharted shoals were to be found. From July 3 to November 4, 1907, 202 square miles of lake area were surveyed, of which 17⅓ miles were swept. Seven new shoals were found, and as a result it became necessary to move the hitherto charted vessel course in the straits proper about 1 mile farther to the north. At the close of operations on November 4, 1907, this survey had been carried well to the east of Cheboygan main light. On its way to winter quarters at Detroit this party made an examination for a shoal reported to exist off White rock near the main vessel track in Lake Huron, about 9 miles south of Harbor Beach. Nothing was found in or near the reported locality.

The third party at the beginning of the fiscal year was engaged on Lake Michigan upon the harbor survey of St. Joseph and Benton Harbor. This survey was completed, and in addition a survey of the harbor at Waukegan, Ill., was made. This party also made soundings over an area of 160 square miles in an unsuccessful effort to locate a shoal reported by the master of the steamer *Morse*. A shoal off Grossepoint, where the steamer *Reed* had grounded in 1906, was found and surveyed. As the fall weather made open-lake work unprofitable, the old triangulation near Waukegan was extended to the shore of Lake Michigan; this with a view to providing control, by water triangulation, for the survey of Lake Michigan south of the parallel of latitude through Grossepoint, Ill.

Due to stormy weather, operations were not resumed until May 18, 1908, when two large parties left Detroit for the field.

The first party at once engaged upon a survey of the vicinity of the vessel course through Manitou Passage. Off Sleeping Bear Point, in the summer of 1907, the steamer *Gary* had been damaged by striking an obstruction said to be uncharted. Other portions of the course also required examination to the extent of an area of 30 square miles, practically all of which required sweeping in order to satisfy all doubt. Up to June 30, 1908, this party had sounded and swept a total area of 21 square miles. To anticipate the report of another year it may be stated that the bowlder ridge struck by the *Gary* was located early in July.

The second party, which was under orders to initiate the above-mentioned survey of the south end of Lake Michigan, was preceded by a small party, which, having identified a sufficient number of the triangulation stations of the old survey, carried the triangulation to the shore near Michigan City, the work of extension being of the degree of accuracy commonly ascribed to tertiary triangulation. From the shore points thus fixed the control was extended westward by means of water triangulation, employing for this purpose the entire party. Sounding and sweeping for this season is to be carried both eastward and westward from Indiana Harbor, in which vicinity natural agencies have apparently built up new shoals and added to old ones already charted. Up to June 30, 1908, this party had swept an area of 22 square miles, all of which was also sounded.

The execution of the survey which terminated in 1882 involved a great quantity of astronomic, topographic, and hydrographic work, all of which was performed with a high degree of skill and accuracy. The result was the preparation of a series of reliable charts for lake vessels and the furnishing of a basis for works of channel improvement upon the lakes themselves and their connecting waters. This original series consisted of 76 charts, all of which were printed in black from copperplates.

The extensive revision of the charts now under way has for its object to show to date the changes, due to natural and artificial agencies, which have taken place in the formerly existing conditions as charted, and to furnish the additional information concerning the greater depth which the present requirements of commerce demand.

As a result of revisions, cancellations, and additions to the original series, based on the later surveys, there are now in force 120 Lake Survey charts, of which 3 are in black from old copperplates, 69 are lithographs in colors from copperplate transfers, 45 are lithographs in colors from stone engravings, and 3 are photolithographs in colors.

The charts issued in colors have all depths of 18 feet and less in blue, showing at a glance where vessels may proceed with safety, and are considered by vesselmen much preferable to the old style printed in plain black and white. This new series of colored charts is believed to constitute a distinct advance in chart construction and printing, and meets with high favor from navigators and others.

During the year the Detroit office has revised, transferred to stone, and printed editions in colors from 16 copperplates, revised and printed second editions in colors from 2 engravings on stone, and engraved on stone and issued in colors 6 entirely new charts of the regular series. For free supplemental issue 2 small insets were prepared by correction of and transfer from existing engravings. For other Government offices 51 maps and drawings were reproduced by

photolithography, new engravings, or transfers from engravings furnished. In addition to the above, revisions of 4 copperplate charts and of 5 stone-engraved charts, and engravings on stone of 3 new charts of the regular series are almost completed.

Of the entire series of charts there had been issued in colors 5 on July 1, 1900; 12 on July 1, 1901; 30 on July 1, 1902; 49 on July 1, 1903; 59 on July 1, 1904; 73 on July 1, 1905; 97 on July 1, 1906; 110 on July 1, 1907, and 117 on July 1, 1908.

Up to February 20, 1890, one full set of charts was issued free to each United States registered vessel. Any additional charts furnished such vessels and all furnished for other unofficial use were sold at the uniform price of 30 cents each. On the date above mentioned the free issue, except for official purposes of the Government, was discontinued pursuant to law, and since then the charts have been sold for all private and unofficial use at prices ranging from 5 cents to 30 cents each, the price being intended in each instance to cover only the cost of paper and printing.

Charts may be purchased at the main office at Detroit, at the Canal Office at Sault Ste. Marie, Mich., and at the United States Engineer Office in Buffalo. Complete sample sets may be seen at the United States Engineer Offices at Duluth, Milwaukee, Chicago, Grand Rapids, Cleveland, and Oswego, enabling purchasers to select exactly the charts they wish to order.

From 1882 to June 30, 1908, a total sum of $30,014.94 was derived from the sale of charts by the Detroit office and deposited in the United States Treasury.

During the fiscal year ending June 30, 1908, the number of charts sold by the Detroit office was 17,207 and by the Buffalo office 2,687, the aggregate sales being 19,894. The proceeds of the sales, amounting to $30,435.17 were deposited to the credit of the Treasurer of the United States. The Detroit office issued 2,494 charts for official use and the Buffalo office 22, a total of 2,516. To date about 362,000 of these charts have been sold and issued for actual service.

In addition to the field work above mentioned and to that upon the charts, operations were continued under the present general project for the exhaustive investigation of lake levels, this being in continuation and extension of the project described in the Annual Report for 1898, pages 3774–3776. The principal field work of the year comprised lake-temperature observations and the maintenance of 13 self-registering water gauges to supply an accurate, continuous record of all changes in elevation of the water surface. Appendix H H H 1 of this report gives a table of discharges of all the Great Lakes at the mean stage of each for the past forty-eight years, as determined from the monthly means shown on the plate in the same appendix. This work is now fully organized, methods of making measurements and observations to the best advantage have become fixed and settled, and the results are of increasing importance, bearing as they do on questions affecting international relations and obligations, and on the propriety and advisability of the numerous diversions under consideration.

The preparation and issue of the series of bulletins, supplementary to the charts, relating to the river and harbor improvements and navigation of the Great Lakes was begun by this office in 1889, and was transferred to the office of the Lake Survey at Detroit in 1902.

Of the last issue, Bulletin No. 18, about 2,400 copies already have been distributed to the marine interests, and requests for it are constantly being received. These bulletins are issued annually, with monthly supplements during the season of navigation, and give the latest and fullest descriptions of progress in river and harbor improvements on the Great Lakes and their connecting waters, as well as significant results of surveys in those waters made under the direction of district engineer officers, and of the Lake Survey. If deemed helpful, small maps showing location of new shoals, changes in important channels, localities hitherto uncharted, etc., are inserted in both bulletins and supplements.

The commerce affected by the operations of the Lake Survey and depending upon the publication and constant revision of charts and bulletins is practically the entire commerce of the Great Lakes. To continue field and office operations at a rate commensurate with the importance of the interests involved requires that appropriations shall be of such amount as to permit the use of the entire plant to its maximum capacity during the relatively short seasons available for profitable work. It is therefore recommended that an appropriation of $125,000 be made for the fiscal year ending June 30, 1910, and that it be formulated as follows:

Estimate for the fiscal year ending June 30, 1910.

For survey of northern and northwestern lakes, including all necessary expenses for preparing, correcting, extending, printing, and issuing charts and bulletins, and of investigating lake levels with a view to their regulation, to be immediately available and to remain available until expended, $125,000.

July 1, 1907, balance unexpended		$74,466.96
Amount appropriated by sundry civil act of May 27, 1908		125,000.00
Collections credited to account:		
Receipts from sale 5 sections sweeping float	$5,833.33	
Receipts from sale 3,500 pounds chart paper	250.00	
Refundment, account of overpayment	.30	
Work done for other engineer districts	1,256.33	
		7,339.96
		206,806.92
June 30, 1908, amount expended during the fiscal year		76,853.13
July 1, 1908, balance unexpended		129,953.79

A table showing the monthly water levels from July 1, 1907, to June 30, 1908, at Marquette, Mich., on Lake Superior; Milwaukee, Wis., on Lake Michigan; Harbor Beach, Mich., on Lake Huron; Cleveland, Ohio, on Lake Erie; and Oswego, N. Y., on Lake Ontario, will be found in Appendix H H H 1.

(See Appendix H H H 1.)

THE CONTROL AND REGULATION OF THE WATERS OF NIAGARA RIVER AND THE PRESERVATION OF NIAGARA FALLS.

The operations under the act of Congress of June 29, 1906, were to determine the effects of the diversion authorized by that act, amounting to 15,600 cubic feet per second on the American side, and of the diversion on the Canadian side of water sufficient for the development and importation into the United States of 160,000 horsepower upon the navigable capacity of the Niagara River, its integrity and proper

volume as a boundary stream, the level of Lake Erie, and on the scenic grandeur of Niagara Falls.

The determination of these questions, so far as physically possible, involves surveys and measurements of levels, of volume of discharge, of current velocities and directions, and of depths over the crest of the falls. As these are operations of a character similar to those ordinarily performed by the Lake Survey, upon the recommendation of the Chief of Engineers the Secretary of War authorized the performance of the work involved therein by the Lake Survey, and for this purpose, on March 20, 1907, an allotment of $5,000 was made from the funds appropriated in that act.

Under the project dated April 30, 1907, operations were in progress when the fiscal year began. In brief language, this project provides for the following observations and measurements: Discharge measurements of the Niagara River to test the continuity of or change in the law of outflow since the measurements of 1898–1900; measurements of the volume of flow over the American Fall; measurements of the volume of the diversions in the canals of the power companies on the American side and in the Erie Canal; the operation of water gauges to establish equivalent lake and river heights; determinations of current lines, depths, and contours in and above the rapids; and the making of such additional surveys as may appear necessary.

Field work was continued until December 14, 1907, when the field measurements were completed and the party returned to Detroit for reduction of the observations and the preparation of the final report.

The reduction of the observations involved a large amount of labor, so that while preliminary reports of important results have been rendered, the final report is reserved to include important additional data soon to be available. To anticipate this report it appears that the limit set by the act for the largest single diversion on the American side, namely, 8,600 cubic feet per second, has been exceeded at times by about 7 per cent, that the flow over the American Fall, under the conditions existing during the summer and fall of 1907, was about 4.8 per cent of the total flow of the Niagara River, the average velocity being about 7 feet per second and the mean of 35 float measurements of depth at the crest of the fall being 1.7 feet, with a maximum depth of 3 feet; that no measurable change in the level of Lake Erie seems to have resulted from the increase of diversions at Niagara Falls between the summer of 1898 and the fall of 1907, the measured lake levels corresponding to the volumes of discharge existing in the fall of 1907, being the same as those derived from the discharge measurements of 1898–99; and, finally, a recent closure of the gates of the power canal belonging to the Niagara Falls Power Company shows that this restoration of between 7,000 and 8,000 cubic feet per second to the river channel above the falls results in a rise of one-tenth foot at the crest of the American Fall.

The conclusion as to the effect upon the level of Lake Erie appeared to require confirmation by additional discharge observations, since it is not in entire accordance with preconceived ideas upon the subject. Accordingly, on the recommendation of the Chief of Engineers, an additional allotment of $3,000 was made by the Secretary of War on May 18, 1908, and since May 25, 1908, a party has been in the field charged with the work of making the additional measurements

regarded as necessary in order to settle the question. Up to June 30, 1908, this party had set 8 self-registering gauges, had made a rating of the current meters, and had measured 10 discharges of the Niagara River.

Permits were prepared in accordance with the provisions of the act of Congress approved June 29, 1906, and were issued by the Secretary of War as follows:

FOR THE DIVERSION OF WATER.

August 16, 1907. To the Niagara Falls Power Company to divert 8,600 cubic feet of water per second from the Niagara River; to the Niagara Falls Hydraulic Power and Manufacturing Company to divert 6,500 cubic feet of water per second from the Niagara River; and to the Lockport Hydraulic Company to divert water of the Niagara River and its tributaries from the Erie Canal at Lockport, N. Y., above the locks, for power purposes, not exceeding 500 cubic feet per second, "it being distinctly understood that the waters so diverted shall be returned to the canal below the locks, and that this permit shall inure to the benefit of all persons and corporations now using said water for power purposes whether lessees of the applicant or having the right to be furnished by it with water, and including the persons and corporations now diverting water as aforesaid from the Erie Canal at Eighteen Mile Creek, Middleport, Medina, Eagle Harbor, Albion, Holley, and other places on the lower level."

FOR THE TRANSMISSION OF ELECTRICAL POWER FROM CANADA INTO THE UNITED STATES.

August 16, 1907. To the Niagara Falls Power Company to receive from the Canadian Niagara River Company at the international boundary line and transmit from the Dominion of Canada into the United States 52,500 electrical horsepower; and to the Niagara, Lockport and Ontario Power Company to receive from the Ontario Power Company of Niagara Falls at the international boundary line and to transmit into the United States 60,000 electrical horsepower.

August 17, 1907. To the Cataract Power and Conduit Company and to the Niagara Falls Electrical Transmission Company and to such other distributing agents or companies in the United States as the Electrical Development Company of Ontario may designate to receive from the said The Electrical Development Company of Ontario (Limited) at the international boundary line and to transmit into the United States 46,000 electrical horsepower.

August 16, 1907, Capt. C. W. Kutz, Corps of Engineers, was designated by the Secretary of War to exercise supervision of operations under permits.

In addition to the expenditures made in connection with the Lake Survey operations, the sum of $1,052.17 has been disbursed by Capt. W. J. Barden, Corps of Engineers, disbursing officer of the office of the Chief of Engineers, for expenses pertaining to the supervision of permits and the operations of the committee appointed by the Secretary of War in connection with the preservation of natural scenic effects at Niagara Falls.

Amount appropriated by act of June 29, 1906	$50,000.00
July 1, 1907, balance unexpended	45,693.02
June 30, 1908, amount expended during fiscal year	5,623.62
July 1, 1908, balance unexpended	40,069.40
July 1, 1908, outstanding liabilities [a]	665.42
July 1, 1908, balance available [a]	39,403.98

(See Appendix H H H 2.)

IMPROVEMENT OF THE YELLOWSTONE NATIONAL PARK, INCLUDING THE CONSTRUCTION, REPAIR, AND MAINTENANCE OF ROADS AND BRIDGES.

Officer in charge, Capt. E. D. Peck, Corps of Engineers.

The Yellowstone National Park was set apart from the public domain and placed under the control of the Secretary of the Interior by act of Congress of March 1, 1872. The sundry civil act of March 3, 1883, directed the construction and improvement of suitable roads and bridges under the supervision of an engineer officer to be detailed by the Secretary of War, and in July, 1883, an engineer officer was designated accordingly. This was the beginning of systematic road construction in the park. The previous work consisted of the opening of such rough trails as the limited means permitted, but they were temporary in character and of little or no value in the permanent plan. Subsequent to the sundry civil act of August 4, 1886, the expenditure for the improvement was transferred to the War Department, and it has been in the charge of the Engineer Department with the exception of the period from August, 1894, to March, 1899.

At the outset the officer of the Corps of Engineers in charge adopted a project (described in the Annual Report of the Chief of Engineers for 1887, p. 3134) for a comprehensive system of substantial roads, which with the change of the act of Congress of March 3, 1891, is the basis of the present system. The sundry civil act of June 6, 1900, directed that the road extensions and improvements should thereafter be made in harmony with a general plan to be approved by the Chief of Engineers. Such plan was approved August 27, 1900, modified by authority of the Secretary of War, dated July 22, 1901, and further modified by approval of the Chief of Engineers, dated July 2, 1902. The sundry civil act of June 28, 1902, recognized this project and provided for its completion, and it was practically finished during the fiscal year ending June 30, 1906. It comprises a belt line or main circuit which reaches all of the important centers of interest, with side roads, bridle trails, and four approaches leading from the park boundary to different points on the belt line—in all, about 350 miles of road and about 125 bridges. The sum expended to June 30, 1908, including maintenance and repairs, is $1,769,490.33. It is estimated that not less than $200,000 of this amount was expended in early work which has since been replaced and does not form a part of the completed system. Maintenance and repairs have cost about $491,821.16, leaving about $1,077,669.17 for the cost of the permanent work. In

[a] The question of pay of the civilian members of the committee appointed by the Secretary of War in connection with the preservation of natural scenic effects at Niagara Falls yet to be determined.

addition there has been expended on work done for other Departments the sum of $850.95, for which the park appropriation has been reimbursed.

The sundry civil acts of March 4, 1907, and May 27, 1908, provided funds for the maintenance and repair of improvements, and projects for the expenditure were approved April 8, 1907, and July 1, 1908. The work of the past fiscal year under these projects included: General repair and maintenance of the entire system, including the Cooke City, East, West, and South roads; repairs to bridges; the replacing of bridges at Alum Creek and Obsidian Creek by culverts and fills; laying of tile and iron culverts; the clearing of dead and fallen timber from the roadside; 85 miles of road sprinkled; a number of pumping stations converted into gravity tanks, and hydraulic rams installed; repairs to sprinkling wagons, road graders, carts, and other vehicles; maintenance of trees, shrubs, vines, and lawns; erection of about 500 enameled-steel signs; a survey for a road from the west boundary of the park at the crossing of the Gallatin River, to a point on the Norris road about 7 miles from Mammoth Hot Springs.

It is proposed to apply the $200,000 estimated as a profitable expenditure during the fiscal year ending June 30, 1910, to work of maintenance and repair, together with the replacing of certain wooden bridges with steel, and commencing the work of resurfacing the system, including the purchase of the plant necessary therefor. The work is necessary to keep the improvement available for use.

More extended information relating to previous operations is published in the Annual Reports of the Chief of Engineers, as follows:

1887, page 3133. A résumé of operations from 1883 to 1887.
1900, page 5420. A general résumé covering the period 1872–1900.
1900, page 5441. The general plan approved August 27, 1900.
1901, page 3797. Modification of 1901 in the general plan of August 27, 1900.
1903, page 2444. General description and technical details of work.
1905, following page 2822. Map of tourist routes.

July 1, 1907, balance unexpended	$57,443.59
Amount appropriated by sundry civil act approved May 27, 1908	65,000.00
	122,443.59
June 30, 1908, amount expended during fiscal year	55,968.91
July 1, 1908, balance unexpended	66,474.68
July 1, 1908, outstanding liabilities	20,180.59
July 1, 1908, balance available	46,294.09
Amount that can be profitably expended in fiscal year ending June 30, 1910, for maintenance and repairs, in addition to the balance unexpended July 1, 1908	200,000.00

(See Appendix I I I.)

ROAD INTO MOUNT RAINIER NATIONAL PARK.

Officer in charge, Maj. H. M. Chittenden, Corps of Engineers.

Prior to the commencement of operations, an inferior road led into the park from the western boundary of the forest reserve to Longmire Springs, a distance of about 10½ miles, and rough trails extended thence to the Camp of the Clouds.

The sundry civil act of March 3, 1903, appropriated $10,000 for a survey of the most practicable route for a wagon road into the park and for commencing construction. An estimate of cost, amounting to $183,000.50, was submitted to Congress March 22, 1904, and printed in House Document No. 631, Fifty-eighth Congress, second session, and an appropriation for continuing construction was made in the sundry civil act of April 28, 1904. The project thus authorized by Congress and the one under which work is being carried on contemplates the construction of a wagon road from the western boundary of the forest reserve to the Camp of the Clouds, a distance of about 25 miles.

The total amount appropriated to date is $190,000, of which $17,216.23 were expended on surveys. The amount expended on the work of the existing project up to the close of the fiscal year ending June 30, 1908, is $137,170.43.

The work accomplished under the various appropriations to the close of the fiscal year ending June 30, 1908, is as follows:

Number of miles of road constructed and in use	14
Number of miles of road partially completed	1.5
Total	15.5

It is proposed to use the amount estimated as a profitable expenditure during the fiscal year ending June 30, 1909, in continuing the road above Longmire Springs, thus increasing the extent of the improvement available.

The report of the field work of the original survey made in 1903 is printed in the Annual Report of the Chief of Engineers, 1904, page 4207. The general location of the proposed route is shown on the map of the survey made in 1904 for a proposed additional road into the park from the east, printed in House Document No. 283, Fifty-eighth Congress, third session.

July 1, 1907, balance unexpended		$57,080.14
Amount appropriated by sundry civil act approved May 27, 1908		50,000.00
		107,080.14
June 30, 1908, amount expended during fiscal year for works of improvement		54,250.57
July 1, 1908, balance unexpended		52,829.57
July 1, 1908, outstanding liabilities		5,000.00
July 1, 1908, balance available		47,829.57
Amount (estimated) required for completion of existing project		25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1909, in addition to the balance unexpended July 1, 1908:		
For works of improvement	$25,000.00	
For maintenance of improvement	5,000.00	
		30,000.00

(See Appendix J J J.)

MAPS, WAR DEPARTMENT.

With the $5,000 appropriated for this purpose for the fiscal year ending June 30, 1908, contracts were entered into for the publication of five harbor charts for the use of the Coast Artillery in the defenses of certain harbors. Maps of Alaska and the Tanana River in Alaska,

of the territory covered in army camps of instruction, of the Manchurian campaign of the Russo-Japanese war, and of the civil war were also printed.

Existing regulations require the commanding officer of each post where there are fixed batteries bearing upon a channel to call upon the Engineer Department for accurate charts, with protractors and range squares thereon, showing also the soundings to the extent of the ranges of the guns. A number of these charts will be ready for reproduction during the fiscal year 1910. It is recommended that $5,000 be appropriated for that purpose, and an estimate of that amount is submitted.

BUILDINGS, ARMY WAR COLLEGE, WASHINGTON, D. C., AND ENGINEER SCHOOL, WASHINGTON, D. C.

Officers in charge, Maj. Chester Harding, Corps of Engineers, to July 13, 1907; since that date Lieut. Col. W. C. Langfitt, Corps of Engineers.

The creation of the Engineer Post and School at Washington Barracks was authorized by an act of Congress, approved June 30, 1902, based on an estimate prepared without funds available for the preparation of detailed plans or for the making of borings, etc. This estimate contemplated the utilization of a number of existing buildings, and provided for construction of new buildings inclosing approximately 4,000,000 cubic feet. A unit of price of about 16 cents a cubic foot of space inclosed in buildings, all contingencies included, was practically the basis of this original estimate. Further development of plans for the Engineer Post and for the War College building authorized in the same act led to the approval by the Secretary of War of a transposition of the locations of the two, so that the latter building now occupies the site originally planned for the Engineer Post. This change led eventually to the abandonment of the effort to utilize old post buildings, which, upon detailed examination, proved also to be in such bad condition as to make repairs expensive and not economical. These facts were reported in general terms in the Annual Report for 1904, page 741, as well as the fact that the Subsistence Department had utilized the post for a distributing depot, which was not anticipated in the original estimates. The army appropriation act, approved June 12, 1906, provided a chaplain for the Corps of Engineers, who has been assigned to station at this post, and a commissary officer has been assigned to permanent station here, both calling for additional quarters.

In view of these and other similar minor changes the cubic contents of the buildings actually provided were increased by increasing the number of buildings as far as funds would permit, actual construction having been almost exactly as costly per cubic foot of inclosed space as the estimate.

The condition of the work at the close of the fiscal year was as follows:

BUILDINGS, ARMY WAR COLLEGE.

This work is entirely finished and the accounts all settled up. For detailed history of this work, reference is made to the Annual Reports of the Chief of Engineers for the years 1902, 1903, 1904, 1905, and 1906.

BUILDINGS, ENGINEER POST AND ENGINEER SCHOOL.

All appropriations made for this object up to and including the act of March 2, 1907, have been expended and the accounts for those appropriations have been finally settled up. For detailed history of this project reference is made to the Annual Reports of the Chief of Engineers for the years 1902, 1903, 1904, 1905, and 1906.

In the army appropriation act, approved March 2, 1907, funds were appropriated for additional work under this project as follows: For completion of two incomplete sets of noncommissioned officers' quarters, $15,000; for construction of one new stable, $17,500. This new work was assigned to the charge of Maj. Chester Harding, Corps of Engineers, on March 16, 1907, and transferred to Maj. (now Lieut. Col.) W. C. Langfitt, Corps of Engineers, July 13, 1907.

During the year the sets of noncommissioned officers' quarters were completed and are occupied. The stable, owing to unexpected great cost of foundations to prevent unequal settlement and cracking, could not be completed, and it is estimated that $1,700 will be required for its completion. This does not show an excess of cost over estimate, as in the estimates submitted by the constructing officer for buildings necessary for completion of the Engineer Post and Engineer School and upon which the above appropriations were made, the usual and necessary 10 per cent contingencies, etc., were included in a lump sum for the whole work. In appropriating for these buildings their proportionate amount of this 10 per cent was not added. The estimated amount for completion of the stable is therefore slightly less than the omitted 10 per cent.

On December 22, 1904, the Secretary of War approved a general layout which, it is thought, completely meets the present needs of the post and school. A drawing of this proposed post accompanied the report of Captain Sewell published in the Annual Report of the Chief of Engineers for 1906. Additional buildings are shown on this sheet. Arranged in the order of their immediate importance, and with the estimated cost of each stated, they are as follows:

1. Completion of stable	$1,700.00
2. Buildings for post headquarters, Engineer School, library and museum, post powerhouse, heating plant, and trade schools	429,000.00
3. Bachelor officers' quarters	70,000.00
4. Completion of west barracks	40,000.00
5. Store sheds for lumber, coal, ponton material, wagons, etc	25,000.00
6. Observatory	3,000.00
7. Roads, walks, sidewalks, sewers, water supply, gas, electric distribution	25,000.00
8. Six sets noncommissioned officers' quarters	66,000.00
9. One new stable	20,000.00
10. Chaplain quarters	20,000.00
11. Hospital	66,000.00
12. Hospital stewards' quarters	10,000.00
	775,700.00

An estimate of this amount is submitted. This estimate differs from that submitted last year only in the substitution of a 10 per cent contingent increase in each item for the general item of $71,600 for contingencies, and in adding $10,000 for two sets of hospital stewards' quarters.

Fuller details of these new buildings and their objects are given in the report of Captain Sewell, published as Appendix H H H of the Annual Report of the Chief of Engineers for 1906.

It is recommended that Congress provide for as many of these items at the coming session as the general condition of the public funds may justify, with a view to the early completion of the post and school.

Amount appropriated by act of June 30, 1902	$500,000.00
Amount appropriated by act of March 2, 1903	360,000.00
Amount appropriated by act of March 2, 1905	150,000.00
Amount appropriated by act of March 2, 1907	32,500.00
	1,042,500.00
June 30, 1908, amount expended to date	1,042,424.85
July 1, 1908, balance unexpended	75.15
July 1, 1908, outstanding liabilities	75.15

(See Appendix K K K.)

CONSTRUCTION OF BRIDGE ACROSS MISSISSIPPI RIVER BETWEEN FORT SNELLING RESERVATION AND ST. PAUL, MINNESOTA.

This work was in the charge of Capt. Edward H. Schulz, Corps of Engineers, until September 4, 1907, and of Maj. Francis R. Shunk, Corps of Engineers, since that date.

The act of Congress approved March 17, 1908, provided for construction of a bridge over the Mississippi River connecting Fort Snelling Reservation and St. Paul. The cost was not to exceed $250,000, of which at least $100,000 was to be contributed by the city of St. Paul, at least $25,000 by any electric railway company receiving right of transit across the bridge, and such sum as the Secretary of War might determine by any steam railway company which might use the bridge.

The sum of $100,000 has been paid to the United States by the city of St. Paul and the sum of $25,000 by the Twin City Rapid Transit Company.

A site has been selected for the proposed bridge, with the approval of the Secretary of War, about 300 feet below the old Fort Snelling bridge.

The necessary land and easement for approaches and right of way have been obtained. A contract has been entered into with Bayne & Hewett, of Minneapolis, Minn., for the construction of the bridge, for the sum of $230,000. The balance of the funds available is reserved for the purchase of land for approaches and right of way and for administration purposes and contingencies.

The amount expended to June 30, 1908, was $29,094.91. About 64 per cent of the substructure has been completed.

July 1, 1907, balance unexpended	$145,871.57
Received from city of St. Paul	100,000.00
	245,871.57
June 30, 1908, amount expended during fiscal year	24,966.48
July 1, 1908, balance unexpended	220,905.09
July 1, 1908, outstanding liabilities	3,592.50
July 1, 1908, balance available	217,312.59
July 1, 1908, amount covered by uncompleted contracts	208,962.50

(See Appendix L L L.)

ERECTION OF MONUMENT TO THE MEMORY OF THE AMERICAN SOLDIERS WHO FELL IN THE BATTLE OF NEW ORLEANS IN THE WAR OF 1812.

This work was in the charge of Maj. J. F. McIndoe, Corps of Engineers.

By act of Congress approved March 4, 1907, Congress appropriated $25,000 for the completion of a monument to the memory of the American soldiers who fell in the battle of New Orleans in the war of 1812. The design of the monument was approved by the Secretary of War May 17, 1907, and the work of construction and disbursement of funds assigned to the Engineer Department. The site of the monument is at Chalmette, La.

The Chalmette monument was originally designed by Newton Richards, whose plans were accepted by the Jackson Monument Association in May, 1855. This design consisted of a plain shaft 142 feet high, resting on five steps, each 2 feet high and starting about 2 feet 6 inches above the natural surface of the ground; the shaft to be 16 feet 8 inches square at the base and 12 feet 6 inches at the top; the base of the shaft to have on the four faces corniced projections surmounted with sculptured emblems, one of these to serve as an entrance to a spiral stairway leading to a chamber at the top; the stair to be lighted by small openings at regular intervals; both shaft and base to be faced with marble.

A contract for the erection of the monument was awarded in June, 1855, but the work was not completed.

At the time Congress made the above appropriation no work had been done for over fifty years, it is said. The shaft was 56 feet 10 inches high, measuring from the top of the mound of earth about 12 feet 6 inches above the natural surface and about 185 feet in diameter which had been placed around the monument to protect the brick foundation. The base was 16 feet 8 inches square outside and 10 feet 8 inches diameter inside; the top was 14 feet 11 inches square outside and 9 feet 11 inches diameter inside.

Under project approved July 6, 1907, it was proposed to remove the mound of earth covering the base of the existing monument, to extend the shaft on the original lines 24 feet 2½ inches and to place thereon a pyramid 9 feet high, making the top of the monument when completed approximately 100 feet above the natural level of the ground. The entire shaft and base are to be covered with marble. A spiral stairway, with iron steps supported by a central brick pier and the brick lining of shaft, leads to an observation

chamber 9 feet 6 inches square in top of monument. There is to be a bronze door at the entrance to the monument, bronze hand rails on both sides of stairway, bronze grilles in the windows of observation chamber, and a bronze historical tablet on the wall of observation chamber.

A contract for the construction of the monument was entered into with M. P. Doullut, of New Orleans, on December 7, 1907, and the work was commenced January 16, 1908. At the end of the fiscal year the shaft had been completed, the only work remaining to complete the monument being a part of the base and the bronze work.

The amount expended to June 30, 1908, is $12,869.56, of which $750 was paid for preparation of plans, $11,541.75 to the contractor, and $577.81 for miscellaneous expenses, inspection, etc.; $0.75 was derived from sale of blueprints.

Amount appropriated by act approved March 4, 1907	$25,000.00
Amount received, sale of blueprints	.75
	25,000.75
June 30, 1908, amount expended during fiscal year	12,869.56
July 1, 1908, balance unexpended	12,131.19
July 1, 1908, amount covered by uncompleted contracts	9,264.75

(See Appendix M M M.)

MONUMENT TO COMMEMORATE THE BATTLE OF KINGS MOUNTAIN, SOUTH CAROLINA.

This work was in the charge of Capt. G. P. Howell, Corps of Engineers, to July 24, 1907, and of Capt. E. R. Stuart, Corps of Engineers, since that date.

By act of Congress approved June 16, 1906, $30,000 was appropriated for the construction of a monument to commemorate the victory of the American forces at Kings Mountain, South Carolina, October 7, 1780. Plans for the monument were approved by the Secretary of War, contract was let for the construction of the monument, and at the close of the year preliminary work was in progress.

July 1, 1907, balance unexpended	$29,927.77
June 30, 1908, amount expended during fiscal year	617.39
July 1, 1908, balance unexpended	29,310.38
July 1, 1908, outstanding liabilities	170.94
July 1, 1908, balance available	29,139.44
July 1, 1908, amount covered by uncompleted contracts	25,000.00

(See Appendix N N N.)

CONSTRUCTION OF MONUMENT AT MONTEREY, CALIFORNIA, TO COMMEMORATE THE TAKING POSSESSION OF THE PACIFIC COAST BY COMMODORE JOHN D. SLOAT, U. S. NAVY.

This work was in the charge of Lieut. Col. John Biddle, Corps of Engineers.

On March 4, 1907, Congress appropriated $10,000 to aid in the completion of a monument to commemorate the taking possession of

the Pacific coast by Commodore John D. Sloat, U. S. Navy, and for the preparation of a site for the said monument on the military reservation at Monterey, Cal. On March 28, 1908, Congress authorized the expenditure of not to exceed $1,000 to secure a suitable design.

Efforts are now in progress to decide upon a suitable design for this monument.

The total amount expended to June 30, 1908, is $1.08.

July 1, 1907, balance unexpended	$10,000.00
June 30, 1908, amount expended during fiscal year	1.08
July 1, 1908, balance unexpended	9,998.92

REPAIR OF BRIDGE OVER NIOBRARA RIVER, BETWEEN THE SANTEE AND PONCA RESERVATIONS, NEBRASKA.

The act approved April 30, 1908, making appropriations for the Indian Department, carried an item of $12,000 for repairing the bridge over Niobrara River, between the Santee and Ponca reservations, Nebr., the work to be done under the direction and supervision of the War Department.

This duty has been assigned to Capt. E. H. Schulz, Corps of Engineers, stationed at Kansas City, Mo., but no work has yet been done.

OFFICE OF THE CHIEF OF ENGINEERS.

During the fiscal year ending June 30, 1908, the following-named officers were on duty in this office as assistants: Col. Smith S. Leach; Lieut. Col. Frederic V. Abbot; Lieut. Col. Harry F. Hodges until July 17, 1907; Maj. E. Eveleth Winslow from September 10, 1907; Maj. James B. Cavanaugh from October 10, 1907; Capt. William J. Barden; First Lieut. Robert R. Ralston from April 14, 1908.

Very respectfully,

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

The SECRETARY OF WAR.

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